THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIV. No. 1383.] LONDON, NOVEMBER 12, 1889. [41ST YEAR. Price 6d.

WOLSTON'S Paste and Ready Mixed for Use.

Warranted Free from Adulteration. **TORBAY PAINTS.**

FOR GASHOLDERS, &c., &c.

The Original "Torbay Paints"

As supplied during many years to the LONDON GASLIGHT & COKE COMPANY.

TORBAY & DART PAINT Co., Ld.,

23, Gt. George St., Westminster, S.W.

DARTMOUTH, & BRIXHAM (TORBAY).

— ESTABLISHED 1830. —

PARKER & LESTER,

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THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

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ORMSIDE STREET, OLD KENT ROAD, LONDON.

Ashmore, Benson, Pease, & Co., Ld.,

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Manufacturing Gas Engineers.

See Advertisement, p. 943.

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BEST

PORTLAND CEMENT

MANUFACTURED BY

GEO. & THOS. EARLE

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PROMPT DESPATCH:

Seven Jetties on the River.

Two Private Railway Sidings.

FACILITIES FOR DESPATCH:

Six Railway-Waggon Entrances with Steam and Hydraulic Cranes.

Four Rully Entrances.

Three different Railway Companies within easy carriage distance.

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WARNER'S RETORT-HOUSE MACHINERY.

[*As Illustrated and Described in the* JOURNAL *for May* 4, 1880.]

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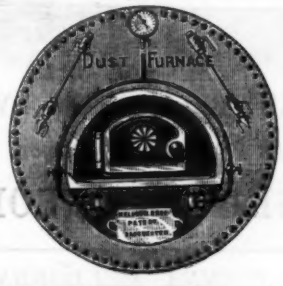
W. J. WARNER, GAS-WORKS, SOUTH SHIELDS.

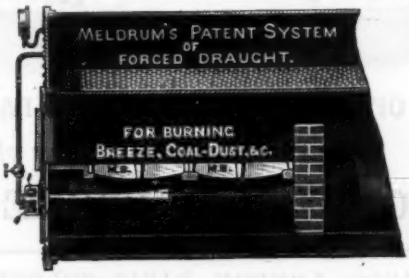
Cool Bars.

Easy Clinkering.

Independent of Chimney Draught.

Without moving parts.





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FOR STEAM RAISING AND RETORT FIRING.

By adopting this System, Gas-Works practically save the whole cost of Fuel.

Knowing the value of these Furnaces, **MELDRUM BROTHERS** are prepared to fit them up, **ON APPROVAL,** to Lancashire, Cornish, Egg-ended, or other Type of Steam-Boiler; also to Retort-Furnaces. Terms on application.

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WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.,

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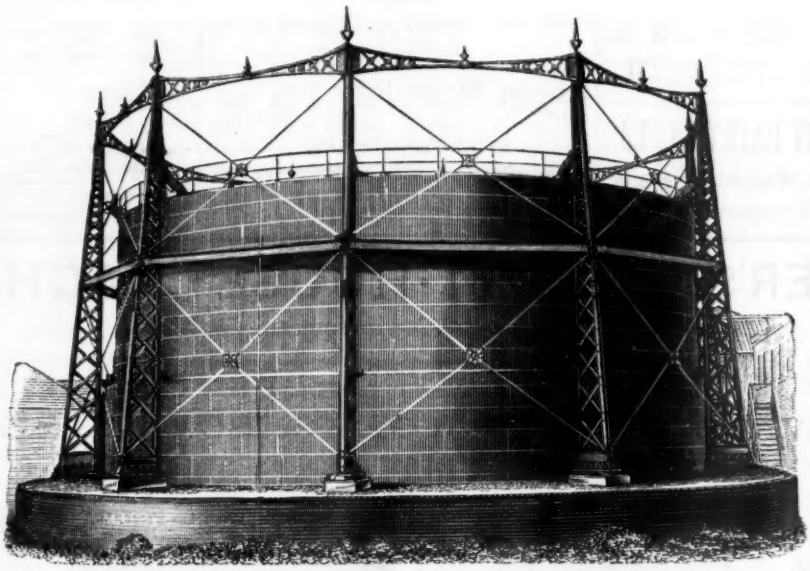

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THOMAS PIGGOTT & CO.,

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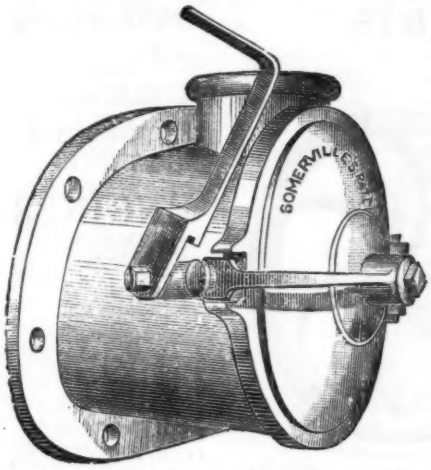

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ALL OF THE MOST APPROVED DESIGNS.

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SULPHATE OF AMMONIA PLANT.

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WHICH ARE SELF-SEALING AND REQUIRE NO LUTING.

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FOR ANY PURPOSE.

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MANUFACTURERS OF

SLIDE VALVES,
WITH RACK & PINION,
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SCREWS, of all Sizes.
GASHOLDERS,
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RETORT-BED FITTINGS,
And Retort-House Appliances
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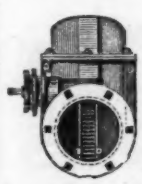
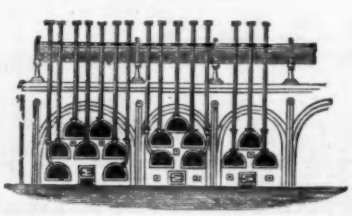
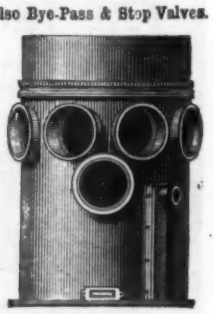
PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.







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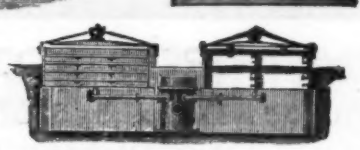

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

100 Prize Medals.

MADE in SIZES
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GAS-ENGINES
COMBINED
WITH
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FOR
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SEWAGE, &c., &c.

GAS-ENGINES
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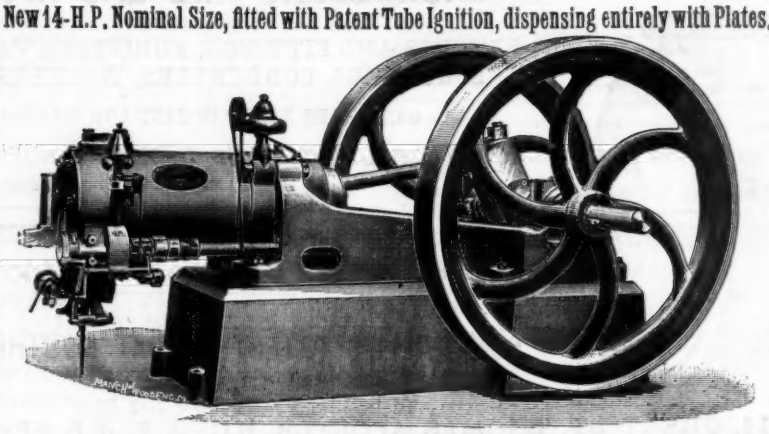
New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



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VERTICAL
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TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS,
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Largely used for
EXHAUSTING,
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Over **31,000** "OTTO" ENGINES are at work.

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FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

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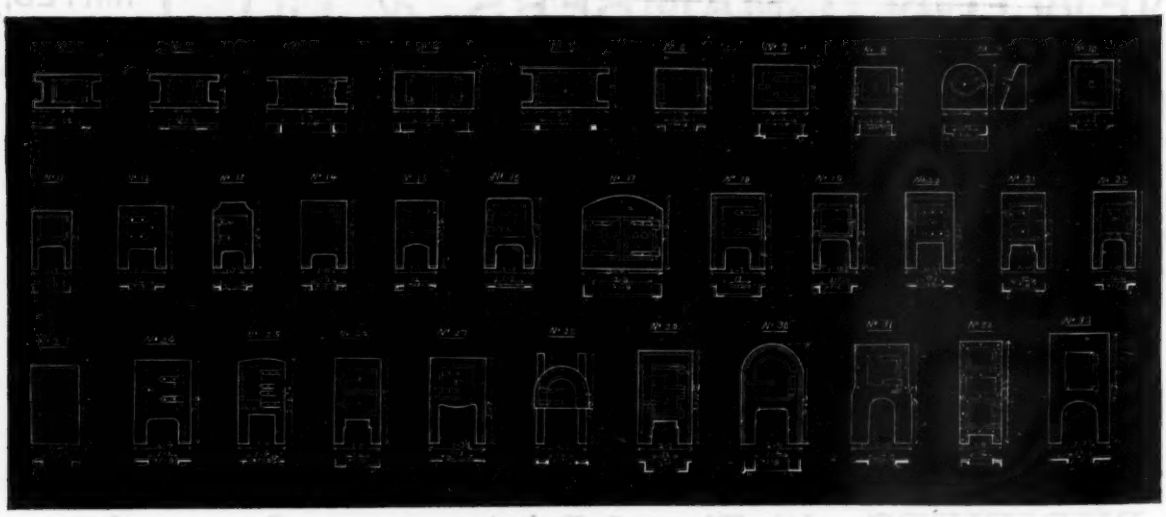
Engineers, Ironfounders, and Contractors,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.



RETORT MOUNTINGS.

Furnace Doors and Frames suitable for Generator, Regenerator, and ordinary Retort Furnaces.

MOST OF THE ABOVE DESIGNS CAN BE MADE IN WROUGHT IRON, IF DESIRED.

Designs made for other Patterns to Order.

CLAYTON, SON, & CO.

ESTABLISHED A QUARTER OF A CENTURY. LIMITED.

MANUFACTURERS OF ALL KINDS OF

GASHOLDERS

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OF EVERY DESCRIPTION.

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HUNSLET, LEEDS.

GAS AND WATER PIPES

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SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

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The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

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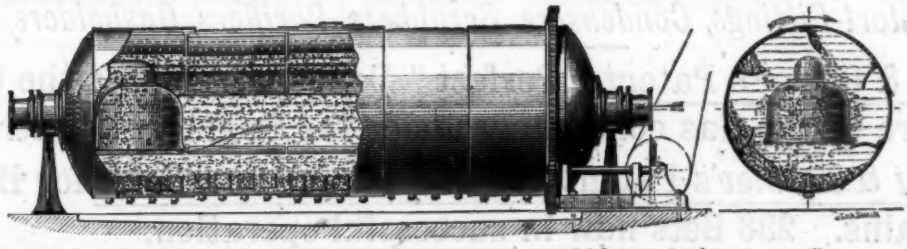
THE REVOLVING PURIFIER

(ANDERSON'S PATENT)

For the Purification of River Water and Sewage Effluent in Large Volumes, and for Removing Colour from Water containing Peat or Clay,

BY AGITATION WITH METALLIC IRON.



MADE IN FOURTEEN SIZES; CAPABLE OF TREATING SINGLY 5000 TO 1¼ MILLION GALLONS PER DAY. REDUCES ORGANIC MATTER FROM 45 TO 90 PER CENT.; TOTALLY REMOVES MICROBES FROM POLLUTED WATER.

GOLD MEDAL, INVENTIONS EXHIBITION, 1885.

Revolving Purifier Company, Limited,

DOCK HOUSE, BILLITER STREET, LONDON, E.C.

TELEGRAPHIC ADDRESS, "GAS LEEDS."

LONDON OFFICE, 60, QUEEN VICTORIA St. E.C.

CLAYTON SON & Co LIMITED, LEEDS.

MAKE

RETORT LIDS

OF ALL FORMS & SHAPES IN IRON OR STEEL BY SPECIAL HYDRAULIC MACHINERY.

PRICES ON APPLICATION.

"THE METEOR."

NEW HIGH-POWER GAS-LAMP,

Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

Particulars and Prices Free.

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SOLE CONSIGNEES FOR GREAT BRITAIN & COLONIES,

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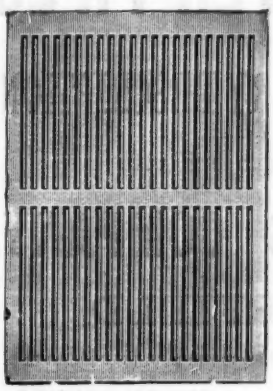
MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

A STOCK OF DIFFERENT SHAPES ON HAND.

R. & J. DEMPSTER'S



WOOD GRIDS FOR PURIFIERS

Made from any kind of Timber, of any Size or Shape, by trained Workmen and specially-designed Machinery.

Quick delivery and accuracy guaranteed.

BOARDS FOR SCRUBBERS

Cut and fitted upon the most successful system.

GRIDS FOR SULPHATE PLANTS.

Prices moderate. Inquiries solicited. Estimates free.

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GAS PLANT WORKS,

NEWTON HEATH, MANCHESTER.

SULPHATE OF AMMONIA PLANT.

MESSRS. CUTLER,

Are now giving special attention to

PLANT FOR THE MANUFACTURE OF SULPHATE OF AMMONIA,

And are prepared to supply Companies with the best and most efficient Apparatus on reasonable terms.

Plans, Specifications, and Prices on Application.

Retort-Fittings, Condensers, Scrubbers, Purifiers, Gasholders, &c.

Morris & Cutler's Patent "Perfect" Condenser places the temperature of the Gas completely under the Engineer's control.

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Cutler's Patent "Simplex" (Automatic Syphon) Distributor. Largely adopted, and very successful.

Cutler's Patent Freezing Preventer Apparatus for Gasholder Cups, Tanks, and Purifier Lutes.

S. CUTLER & SONS, MILLWALL, LONDON.

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9, BRIDGE ST., WESTMINSTER.

Mr. S. HERSEY, Managing-Director.

THE "NEW" PATENT

"Standard" Washer-Scrubber,

As supplied to and in course of construction for —

The Gaslight and Coke Company, Beckton Station.
" " Pimlico "
The South Metropolitan Gas Company, Vauxhall Station.
The Liverpool United Gas Company.
Barry and Cadoxton Gas Company.
Hitchin Gas Company.
Melbourne Gas Company.
Workington Corporation.
John Brown and Co., Limited, Atlas Steel Works, Sheffield.

Thoroughly extracts every grain of Ammonia and a large quantity of other Impurities from Gas.

Has been for many months in successful and satisfactory operation at The Gaslight and Coke Company's Station at **BECKTON,**

Resulting in a second order just received to fit up a Washer-Scrubber, of 2½ millions capacity, upon this new principle, at the same station. Other orders for these machines are in course of execution.

A very large amount of patronage has been accorded the "Standard" Washer-Scrubber, of which, up till now, **367** have been supplied, representing a daily make of **318,260,000** cubic feet of gas; but the advantages of the **"New Standard"** will be readily recognized, and its superiority over the present "Standard" may be briefly summarized as follows:—

1. The weight in motion is **only one-seventh** of that in the present machine.
2. It requires **only one-seventh** the power to drive; consequently effecting a large reduction in cost of Engine as well as in steam power.
3. **The Wear and Tear is enormously reduced,** as the Shaft has comparatively little weight to carry.
4. It has been found that the washing surfaces **keep perfectly clean** and free from deposit from end to end of the Machine.
5. It is so constructed that it forms a most powerful, effective, and complete system of purification, gives no pressure, and can be removed and replaced without trouble or injury.
6. The "New Standard," owing to the foregoing, can be supplied at **a large reduction in price.**

Engineers desirous of working Ammoniacal Liquor over and over again prior to leaving the "New Standard" can do so by the automatic and simple arrangement which forms part of this Patent.

The Apparatus can be applied to "Standard" Washer-Scrubbers already in use.

Particulars will be furnished upon application to the above address.

R. LAIDLAW & SON'S
STATION METERS
IN ROUND OR SQUARE CASES, ALL SIZES.

Makers in EDINBURGH of

WET AND DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS,
(To Indicate New Time),
PRESSURE GAUGES, TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
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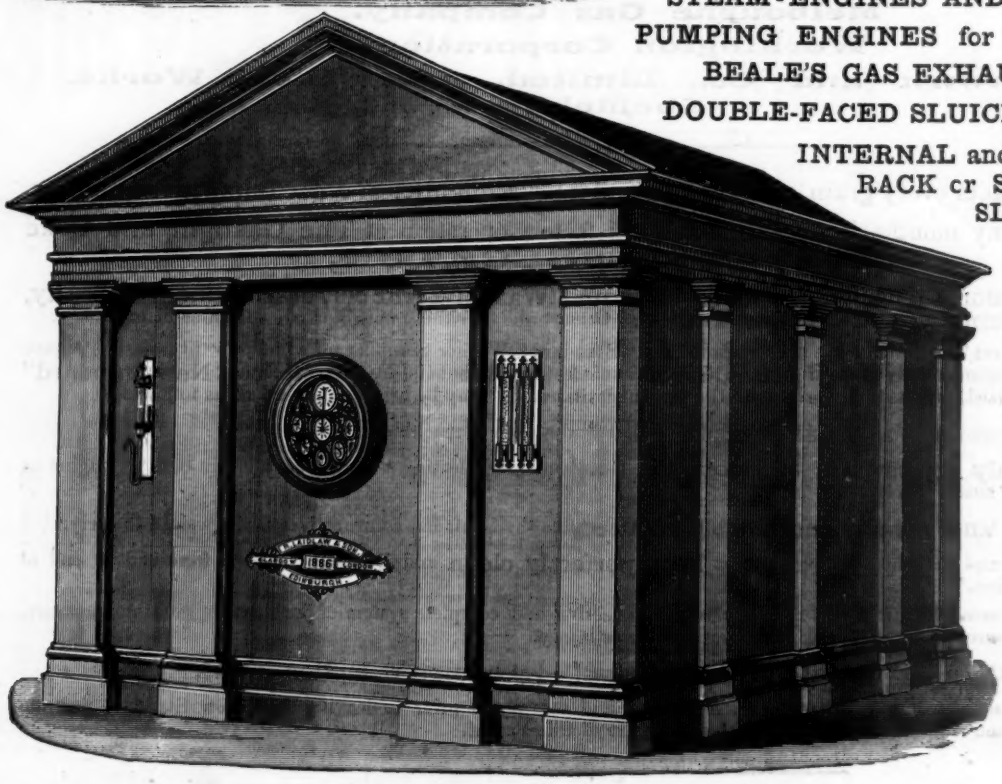
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.

Makers in GLASGOW of

CAST-IRON PIPES (all Sizes),
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES for Water-Works,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL and EXTERNAL RACK cr SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, and WATER TANKS.
WROUGHT-IRON TUBES, FITTINGS, &c.



Descriptive Price Lists, Estimates, & full particulars forwarded on application.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

TANGYES LIMITED,

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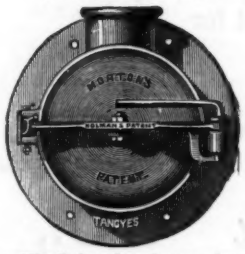
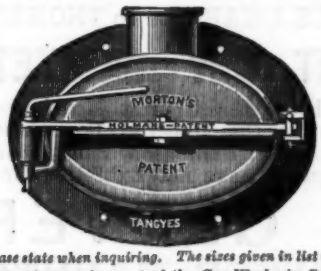
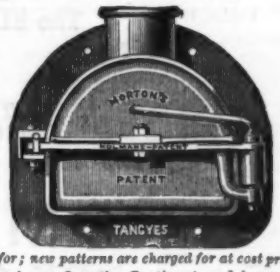
NEWCASTLE-ON-TYNE ST. NICHOLAS BUILDINGS
MANCHESTER . . . . . DEANSGATE
GLASGOW . . . . . ARGYLE STREET

Sole Makers of **MORTON'S** Patent Self-Sealing **RETORT-LIDS,**

With Anti-Friction CATCHES, and Self-Sustaining CROSS-BARS.







Price of Mouthpieces depends on number required, which please state when inquiring. The sizes given in list we have patterns for; new patterns are charged for at cost price.

These Patent Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, D, oval, and round (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 „	18½ „ 12 „	12½ „	0 19 0
6851	15 „	16 „ 14 „	18 „	1 0 0
3629	15 „	18¼ „ 13½ „	14 „	1 0 0
3580	15 „	21 „ 15 „	15 „	1 0 0
6264	16 „	18½ „ 15½ „	15½ „	1 1 0
5210	16 „	20 „ 14 „	15 „	1 1 0
6263	16 „	24 „ 16 „	13½ „	1 1 0
5370	17 „	20 „ 14 „	14 „	1 3 0
6832	17 „	20 „ 14 „	17 „	1 3 0
6183	17 „	20 „ 15 „	15 „	1 3 0
4289	17 „	21 „ 15 „	14 „	1 3 0
5270	17 „	22 „ 14 „	14 „	1 3 0
3631	18 „	18 „ 14 „	20 „	1 5 0
3681	18 „	21 „ 14 „	13½ or 15 „	1 5 0
3554	18 „	21 „ 15 „	14½ „	1 5 0
7957	18 „	22 „ 16 „	14 „	1 5 0
8048*	19 „	25½ „ 15 „	18 „	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
9800	18 × 14½ ins.	18 × 14½ ins.	15 ins.	£1 5 0
9205	20 „ 13 „	24 „ 14 „	10½ „	1 10 0
10000	20½ „ 14½ „	20½ „ 14½ „	15 „	1 10 0
9680	21 „ 15 „	21 „ 15 „	15 „	1 12 0
10056	21 „ 14½ „	21 „ 14½ „	15½ „	1 12 0
13218	21 „ 15 „	21 „ 15 „	17 „	1 12 0
10514	22½ „ 15½ „	22½ „ 15½ „	13½ „	1 13 0
13766	20 „ 17 „	20 „ 17 „	15½ „	1 15 0
13269	24 „ 15 „	24 „ 15 „	16 „	1 18 0

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Mouthpieces for Round Retorts.

Diam. .. .. ins.	14	15	16	17	18
Price, Lid and Fittings without Mouthpiece £	0 19 0	1 0 0	1 1 0	1 3 0	1 5 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
3463	15 „	15 „ 13 „	14 „	1 0 0
6678	15 „	15 „ 14 „	12 „	1 0 0
3661	15½ „	15½ „ 13 „	12 „	1 1 0
13052	16 „	16 „ 13 „	18 „	1 1 0
5601	16 „	16 „ 14 „	15 „	1 1 0
6827	16 „	16 „ 14 „	17 „	1 1 0
4494	16 „	16 „ 14 „	14 „	1 1 0
3548	16 „	16 „ 15 „	12½ „	1 1 0
6877	16 „	16½ „ 13½ „	12½ „	1 1 0
9645	16 „	16½ „ 13½ „	12½ „	1 1 0
4434	16 „	17½ „ 14 „	14 „	1 1 0
6469	16 „	18 „ 14 „	15 „	1 1 0
9015	16 „	18 „ 14 „	18½ „	1 1 0
4327	16 „	18 „ 15 „	15½ „	1 1 0
8049*	16 „	18 „ 15 „	17½ „	1 1 0
6137	16 „	20½ „ 13½ „	13½ „	1 1 0
5918	17 „	18 „ 14 „	14 or 17 „	1 3 0
5053	17 „	19½ „ 12 „	14½ „	1 3 0
7548	17 „	20 „ 13 „	15 „	1 3 0
6468	17 „	20 „ 16 „	15½ „	1 3 0
4316B	17 „	21 „ 14 „	14 „	1 3 0
7975	17 „	21 „ 15 „	14½ „	1 3 0
13459	17 „	21½ „ 13½ „	15 „	1 3 0
12990	18 „	18 „ 15 „	15 or 19 „	1 5 0
7135	18 „	18½ „ 15 „	13 „	1 5 0
10221	18 „	18 „ 16 „	12½ „	1 5 0
4506	18 „	20 „ 13 „	19½ „	1 5 0
6475	18 „	20 „ 13 „	15 „	1 5 0
6818	18 „	20 „ 13½ „	17½ „	1 5 0
4083	18 „	20 „ 15 „	16 „	1 5 0
5306	18 „	20½ „ 14 „	13½ „	1 5 0
13295	18 „	20½ „ 14 „	19½ „	1 5 0
7356	18 „	20½ „ 13½ „	13 „	1 5 0
4569	18 „	21 „ 14 „	18 „	1 5 0
3628	18 „	21 „ 15 „	16 „	1 5 0
7640	18 „	22 „ 12½ „	13½ „	1 5 0
7971*	20 „	20 „ 15 „	18 „	1 11 0

*Patterns marked * have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.* 191

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	13 ins.	£1 2 0
9967	16 „ 14 „	16 „ 14 „	15½ „	1 3 0
13574	16½ „ 13½ „	16½ „ 13½ „	13½ „	1 4 0
9899	18 „ 12 „	18 „ 12 „	14 „	1 4 0
12980	16 „ 16 „	16 „ 16 „	18 „	1 6 0
13900	18 „ 13½ „	18 „ 13 „	15 „	1 6 0
9912	18 „ 13½ „	18 „ 13½ „	17 „	1 6 0
9962	18 „ 13½ „	18 „ 13½ „	16 „	1 6 0
10982	18 „ 13½ „	18 „ 14 „	15 „	1 6 0
11098	18 „ 14 „	18 „ 14 „	12 „	1 6 0
9492	20 „ 13 „	20 „ 13 „	15 „	1 10 0
9208	20 „ 13 „	20 „ 13 „	19½ „	1 10 0
10251	20 „ 13 „	20 „ 13 „	15½ „	1 10 0
12964	20 „ 13 „	20 „ 13 „	13½ „	1 10 0
9909	20 „ 13½ „	20 „ 13½ „	17 „	1 10 0
12969	19½ „ 15½ „	19½ „ 15½ „	14 „	1 11 0
13781	20 „ 15 „ Front. / 21 „ 15 „ Back.	21 „ 15 „	15 „	1 11 0
7892	21 „ 15½ „	21 „ 15½ „	16 „	1 11 0
12978	20 „ 16 „	20 „ 16 „	17 „	1 11 0
13252	20 „ 16 „	20 „ 16 „	18 „	1 11 0
13220	21 „ 15 „	21 „ 15 „	17 „	1 11 0
8977	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 11 0
8976	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 12 0
10497	21½ „ 13½ „	21 „ 13½ „	18½ „	1 12 0
8037	21½ „ 13½ „	21½ „ 13½ „	18½ „	1 12 0
9908	21½ „ 13½ „	21½ „ 13½ „	15 „	1 12 0
10404	21½ „ 13½ „	22 „ 14 „	18½ „	1 12 0
12410	21½ „ 13½ „	22 „ 14 „	12 „	1 12 0
13822	21½ „ 13½ „	22 „ 14 „	15 „	1 12 0
10515	22½ „ 12½ „	22½ „ 12½ „	13½ „	1 12 0
7924	24 „ 14 „	24 „ 14 „	15½ „	1 13 0
13807	24 „ 15½ „	24 „ 15½ „	16 „	1 14 0
9015B	25 „ 14 „	25 „ 14 „	12½ „	1 14 0
10932	25 „ 14 „	24 „ 14 „	18½ „	1 15 0
12944B	22 „ 16 „	22 „ 16 „	16 „	1 15 0

Patterns marked B have curved bottoms. 192

HUNT'S PATENT EQUILIBRIUM DIRECT MAIN

GAS GOVERNOR.

In this Governor a throttle valve is substituted for the ordinary suspended cone; all external communication being avoided by placing the lever or radius arm inside the valve chamber upon the disc.

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6 „ .. 22 10	12 „ .. 38 0	18 „ .. 50 0	36 „ .. 130 0

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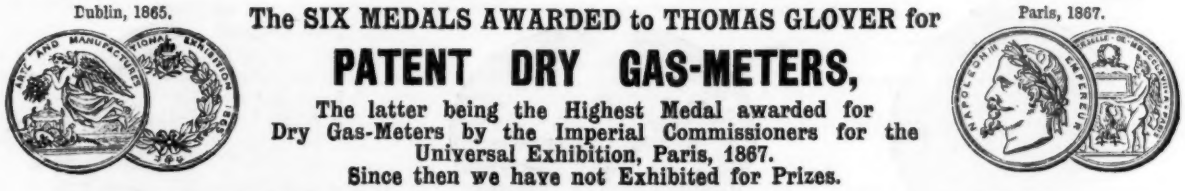

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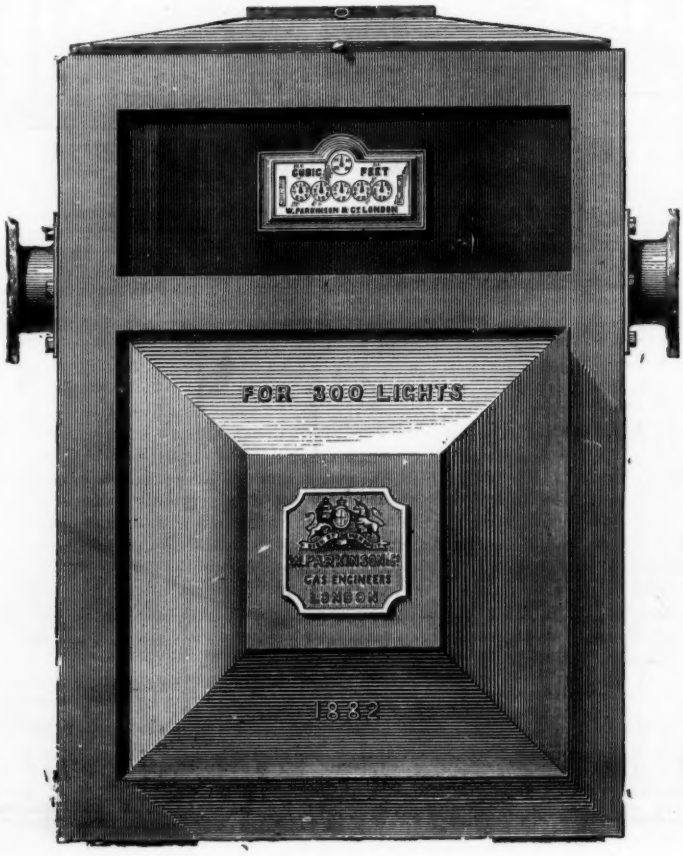

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 12, 1889.

A PROFIT-SHARING SCHEME FOR GAS WORKMEN.

THE communication from Mr. George Livesey, which we publish in another column, will be generally received as a notable contribution towards the settlement of the labour question, at least in so far as sliding-scale Gas Companies are concerned. Whether or not it will be accepted by the Society men remains to be seen; but, at any rate, it is a great departure in the direction of uniting, by the most evident bond of self-interest, the workmen to the Company they serve. Briefly stated, the scheme is one for "profit-sharing," and is designed on the following basis: An initial price of gas is chosen for the starting-point; this in the case of the South Metropolitan Company being 2s. 8d. per 1000 cubic feet, which was the price charged three years back. The calculation from the price of three years ago is made for the sake of giving the scheme a good start. The workmen are to get an addition of 1 per cent. on their year's wages for every penny reduction in the selling price of gas during this period. For the first year the bonus is after the rate of 2 per cent., because the price of gas came down to 2s. 6d.; for the second year it is 3 per cent.; and it is now 5 per cent., as the price of gas is 2s. 3d. per 1000 cubic feet. By taking these three years together, the men who accept the scheme have a sensible immediate bonus—in the case of a 30s. per week man, of rather more than £6; in that of a 24s. per week man, of about £5; and so on. The amount will be placed to the man's credit in an account opened in his name; and interest on it at the rate of 4 per cent. will be allowed by the Company, which may either be drawn by the man yearly, or allowed to accumulate at compound interest. When the man attains a certain age or length of service, or quits his employment, he will be entitled to the whole amount of principal and interest; and it may also be drawn out under some other conditions. This is the sum and substance of as remarkable a scheme as we remember to have been made acquainted with, even in connection with the development of the experiment-favouring South Metropolitan Company.

The arrangements for working the fund are an essential part of the plan. The men who desire to participate have nothing to pay, as in the case of a provident fund; but they are required to enter into an agreement for service by the year (since the scheme is based upon a yearly average of price), which, however, does not bind them absolutely to remain in the Company's employ under all circumstances. A most important feature of the project is that of the settlement of details by a Joint Committee composed of equal numbers of workmen's delegates and of officials nominated by the Directors, to be presided over by the Chairman. We believe it is in contemplation to erect this Committee, supposing it to be formed, into a sort of Arbitration Board, for the settlement of all points connected with the wages and circumstances of the workmen. In this event, the Chairman would not have a casting vote, but an equal division of the Committee would be laid before an Umpire appointed by some independent authority. The last paragraph of the notice offering this scheme to the workmen is significant, and must be quoted in full. It states that "this offer is made as a "recognition of faithful service in the past, and as an "inducement to the same in the future. The money will be the "absolute property of the men, except in the case of a strike "or wilful injury to the Company, in which cases, and in "these only, it will be forfeited by those men guilty of "that conduct." There is no ambiguity about this last sentence. It is understood, of course, that no alteration for the worse is to be made in the men's pay or conditions under an arrangement which is expressly designed for their benefit. If all the Company's workmen take advantage of the offer, it will cost £12,000; but this is not likely to happen at first. There is no statement as to how long the offer will remain open; but there will be no hurry to close it until the men have had ample opportunity for turning over the subject in their minds. There are no limitations to any particular class of workmen; all who appear on the Company's pay-sheets may come in. To some, the opening will seem a perfectly dazzling one; while others, after the manner of sceptics, will ponder over what they can gain and what they may lose by it. They give up the vague possibility of striking, and get a permanent stake in the Company, the value of which the more thoughtful among them can hardly fail to appreciate.

We will not, however, argue on the *pros* and *cons* of the scheme at this time. If it comes into practical operation—or rather, we should say, when it comes into operation; for it was promised that if only one man in the Company's service accepted it, he should not be deprived of his benefit through the holding aloof of the rest—it will be an interesting addition to the multifarious "profit-sharing" plans that have been proposed of late years with the object of capitalizing; for the benefit of the wage-earner, a proportion of the profit made by the employer on his labour. There is a difference of principle between all these projects and provident and insurance funds, to which the workman contributes by his own frugality. They forcibly express the repugnance of the community at the spectacle of a man who has worked all his life (say) in one factory, ending his miserable old age in the workhouse, while his employer founds a county family. Frugality is not in question here. Circumstances may have made

it absolutely impossible for the wage-earner to save enough out of his pay to provide for his useless old age; while for the master both men and machinery have combined to form one huge automatic profit-making apparatus. None of us needs to go very far into his own experience to discover examples where worn-out men have been cast aside, to find their way to that social scrap-heap the workhouse, just like the old machines which they once tended. The feeling of the age is against this sort of thing, whether excused under the phrases of the political economist or not. If it is Socialism to desire a way out of this reproach of our industrial system, then a good many people are Socialists without knowing it. The production of one gorged capitalist for so many hundred pauperized mill-hands, is not now regarded as a result of civilization of which a community has any reason to be proud. The difficulty always is how to cure the evil. No sensible man wishes to frighten capital with any talk of confiscation, or to deny to capital a legitimate portion of the profits of industry. The question is, however, whether a middle way cannot be found between giving the whole profit to capital, as at present, and allowing it none at all, as in the dreams of the Social Democrat. Of course, it is impossible to ignore the fact that very often capital gets no profit under the present system; and it would be idle to talk of sharing what does not exist. In such cases the workman would lose his interest in the results of his labour, which would be sufficient deprivation if his fellows engaged in paying operations were more fortunate. It may be hardy in us to ask the question; but might it not be found possible, in the case of a prospering and profitable industry, to allocate to the steady workman such a share, representing a proportion of the profit on his labour, as shall render him independent of the poor law? In this way, the only workmen to be found in the workhouses would be "wasters," and men who had been chained all their lives to unprosperous callings. This is all chimerical, of course; for difficulties, which nobody has yet succeeded in surmounting, confront the employer who should attempt to realize the dream. There are so few data to go upon in making the first move towards the settlement of the standard of division of profits, that no one knows what to do. Industry is so complicated, and simple rules go such a little way in interpreting its reactions and tracing its ramifications. Here is indeed the latest riddle of the Sphinx, which nevertheless employers occasionally perceive, by the light of strikes, that they must answer, or be torn in pieces. Amid the mists and confusion round and in this question, the South Metropolitan experiment shines like a ray of sunlight. Here at least is a definite proposal with an intelligible datum—the price of gas three years ago. Whether this is the best datum is not for us to argue now. The proposal has been made, and will go forward for good or evil. The least we can say of it is that it is an experiment creditable to the traditions of the Gas Company which was, we believe, the first to give workmen's holidays with pay, and was among the foremost to create sick and superannuation funds and abolish Sunday labour.

THE TRIAL OF THE COZE SYSTEM.

It has been reported to us that the trials of the Coze system with English caking coal, which were arranged to take place last week in Rheims, in the presence of a party of English gas engineers, have passed off with complete success. Both North Pelton and Pelaw Main coals have been carbonized in the inclined retorts; and if they will deal satisfactorily with these materials, they are good for everything in the way of caking coal. Upon this point the information sent to us leaves no doubt. Charges of 3½ cwt. were worked off thoroughly in four hours; the coal being uniformly spread over the floor of the retort, and the coke drawn with the greatest ease—this part of the operation not occupying more than 35 seconds. Smaller charges are handled with equal regularity; which is an additional proof of the success of M. Coze's combination. It is in the highest degree pleasing to learn, on the unexceptionable testimony of Mr. Henry Woodall and the other members of the party of inspection at Rheims, that their trouble, and our recommendation, have not been thrown away; and that a system of retort-working has really been found which may supersede machinery as well as hand labour in coal carbonization. Nothing can be simpler than the whole scheme of working the inclined retort; and when adapted to stage-houses, as it will be when introduced into England, it may be developed to an extent that even M. Coze can hardly anticipate. There is no half-success in a thing of this kind. If an engineer of a large English works takes it in hand, it will be to put it to the test of hard use on a large scale; and doubtless this will be done in more places than one before this time next year. The success of the Rheims experiment puts the whole matter upon a different footing to that which it occupied while it was only a question of carbonizing French or Belgian coals. These might or might not resemble English coals in their behaviour under the influence of heat in the retort; but, at any rate, they are only used in a comparatively few gas-works on the Continent, which gave English gas managers an excuse for overlooking experiments based upon them alone. Now, it appears, there is no such excuse. The system of inclined retort-setting has awakened out of a long sleep, and apparently means business. It is not by any means the only case of a process revived with success through the alteration of some minor point of design or working equipment. We have to warn M. Coze, however, that with success his troubles will begin. Rivals may be expected to spring up on every side; and every gas engineer who adopts the original system into his works will do his best to improve upon it. This is the way of the world with all but a very few successful inventions. Nobody wants to attack an unsuccessful invention; it is when the success has been won that the danger arises.

MR. SLATER ON THE AMERICAN GAS INDUSTRY.

The Inaugural Address of Mr. A. B. Slater, of Providence, Rhode Island, President of the American Gaslight Association, contains some interesting reading. At the very outset, Mr. Slater plunges into the gist of his matter by declaring that there are few American Gas Companies whose books do not show an increase in the quantity of gas distributed; the increase being generally greatest in the larger cities, where competition is most active. This ought to be an encouraging message for gas shareholders on this side, who, with better means for meeting it, have no experience of the competition with which American gas makers have had to reckon for many years past. In the matter of electric lighting, for example, the rivals of the Gas Companies in United States towns have been free to do anything that they pleased. Mr. Slater says: "Instead of adopting uniform rates, and "pursuing a policy of treating all customers alike, prices have "been offered to suit circumstances, and induce the consumer of gas to abandon its use and take the electric "light." This policy has succeeded, of course, in many instances, but not in all cases. Although millions of dollars, as Mr. Slater admits, have been invested in the electric lighting business in the States, and the light has gone everywhere, "the gas business was never in a more prosperous "and flourishing condition than it is to-day. Never in the "history of the business was so much gas distributed as is "being done this very year." Upon the question which has been so much debated in the States—whether or not electric lighting should be combined with gas supply—Mr. Slater takes the negative side. He says he has yet to hear a reasonable and satisfactory argument for the combination in all cases. He declares his firm belief "that the business of any "Gas Company will be managed better, and will be more "prosperous, when the manager devotes his whole time, "attention, and energy to it; and just in proportion as his "mind is diverted from it, whether by the electric light or "any other business, his gas interest must in some degree "suffer from neglect. . . . My observation leads me to "believe that bad results have followed already, at least in "some instances, where Gas Companies have taken upon "themselves the management of electric light in addition to "their own business." Mr. Slater went on to hint that where Gas Companies were supposed to make a good thing out of electric lighting, it might often be found, on investigation, that this was being done at the expense of the gas interest. All this is very sensible, and, moreover, clearly shows that Mr. Slater is a man of courage, to say so much against the most cherished notions of many of his auditory. The President counselled the gas men of America to do something great in connection with the proposed quadri-centennial celebration, in 1892, of the discovery of the New World by Columbus. This celebration is to take the shape of an Exhibition (or, as some writers of American will persist in calling it, an "Exposition"), the object of which is to show how much the country has improved since the time when the noble red man had it all to himself. The great success of the French Exhibition has fired Yankee ambition to "go "better," according to the language of the national game. Let us hope the effort, if made, will be more successful than the Philadelphia affair, which did not end in showing that

the organizing of an International Exhibition is a stronger point with the citizens of the Great Republic than it is with ourselves.

THE REVIVAL OF TRADE.

That a great change has come over the state of trade scarcely needs further proof than is to be found in the every-day experience of our readers; but space must be found for mentioning the excitement in the iron market which marked several days of last week, especially in Glasgow. Iron has risen seriously in price; and there are not wanting people to prophesy that it will go considerably higher before it has a drop. Six months ago, Scotch pig iron warrants stood at 42s. 6d., and now they have touched 60s.; all other varieties of iron having participated in the expansion of value. What is more, it is asserted that there is not enough iron on hand to supply the increasing home demand, to say nothing about foreign trade. There is a good deal of speculation about all this, of course; but no one can imagine speculation alone raising the iron trade into prosperity, even for a moment, from the depression in which it has languished for so many years. It seems only reasonable to suppose that trade is really good; and fortunately there is evidence to the same effect with relation to other trades than that in pig iron. Manufacturers everywhere seem to be fully employed; and Gas Companies whose prosperity is involved with that of manufacturing towns will see with the current season the turning over of the "new "leaf," for which they have been waiting for so long with such exemplary patience.

The Gaslight and Coke Company's Cookery Lectures.—The lectures on cooking by gas which were inaugurated a few months ago by The Gaslight and Coke Company, and noticed in the Journal at the time, were resumed last week at the Assembly Rooms, Defoe Road, Stoke Newington, by Mrs. R. Wilkinson, and were attended by large and appreciative audiences. The lectures, which were given with practical demonstrations on the platform, will be continued at the same place each afternoon and evening from to-day till next Friday. As on previous occasions, there was a good representative exhibition of gas-stoves and other appliances by Messrs. H. and C. Davis and Co., Messrs. Thomas Fletcher and Co., Messrs. W. Sugg and Co., Limited, and Messrs. J. Wright and Co. The arrangements for the lectures and exhibitions in this portion of the Company's area are in the hands of Mr. T. J. Bird, the Chief Inspector of the district, and of Mr. W. H. Godlongton, the Inspector in charge.

Presentation to Mr. J. Burton.—Mr. Joseph Burton, foreman at the Accrington Gas Company's works, was last Thursday the recipient of a handsome travelling-bag, with toilet set, as a mark of the esteem in which he is held by the workmen under his charge. Mr. Burton has recently been appointed to a similar position in connection with the Montreal Gas-Works, under Mr. S. E. Stevenson, and takes his departure in the course of a week. Mr. Charles Harrison, the Company's Secretary and Manager, in making the presentation, bore testimony to the character and abilities of Mr. Burton, and expressed his regret, and that of the Directors, that they were about to lose his services. He, however, was pleased to hear of his success; and expressed a hope that his new undertaking would bring pleasant associations and increased prosperity to himself and his family. Mr. Burton, in acknowledging the gift, expressed his pleasure that he should be so much esteemed on the eve of his departure for Canada. He thanked Mr. Harrison and the Directors of the Company for their past kindness; and the workmen, with whom he had been closely associated, for the unexpected present he had received, and also for their good wishes.

Sudden Death of the Engineer to the London County Council.—We regret to have to record the sudden death of Mr. Joseph Gordon, Engineer to the London County Council, which took place last Saturday while on his way, in an omnibus, from his residence at Hampstead to his office in Spring Gardens. Mr. Gordon, who was born in 1836, began his career in the office of the City Surveyor at Cardiff, and he subsequently became Borough Surveyor of Carlisle. He designed many plans for the draining of large towns in the North of England and Scotland. In 1886 he was appointed to design and carry out a very important sewerage scheme at Frankfort-on-the-Main. He also prepared plans for the sewering of Stuttgart, Heilbronn, Munich, Nüremberg, Hamburg, Aix-la-Chapelle, and other Continental towns. In 1880 he became Borough Surveyor of Leicester, where his extensive operations greatly reduced the death-rate. He carried out flood works costing upwards of £280,000; and he also designed the sewerage works now in progress, which will cost more than £300,000. He possessed great engineering ability, and was endowed with ceaseless energy and activity; but it is feared these qualities aggravated the affection of the heart from which he suffered. He was a member of the Institution of Civil Engineers, of the Institution of German Engineers, and of several other Continental engineering and technical societies. Mr. Gordon had only held his appointment in the County Council since the month of July; and so had hardly got into full work. He leaves a widow, and several sons and daughters.

Water and Sanitary Affairs.

In the annual report of the Local Government Board, issued last week, the subject of the Metropolitan Water Supply holds a somewhat conspicuous place; and attention is again called to the apprehensions of General Scott, that the water supply of the North and East of London is entering into a critical stage. In General Scott's report for the past year, as published in the present Blue-book, it is stated that each summer the whole volume of the Lee is practically used up by the New River and East London Companies for the supply of their districts, supplemented by about 15 million gallons daily from wells; the East London Company also having the aid of 10 million gallons from the Thames. The year 1893 is, according to General Scott, the year of fate for these Companies, when "the possible maximum demand" will be such that they will have fully to double the quantity they now derive from their wells, so as to make it as much as 30,500,000 gallons per day. Three-fourths of the increased well supply will have to be obtained by the East London Company; and both Companies are already practically drawing on the same underground reservoir. Then follows the fear expressed last year, that in drawing from the wells there will be a depletion of the springs that feed the Lee. Concerning the other portions of the London Water Supply, it is consolatory to find it stated that "there "does not seem to be any ground for immediate anxiety" in respect to the supply from the Thames, as affecting the population of the southern and western districts. It is estimated that in 1893 the quantity of water taken from the river might average 36 per cent. of the volume of the stream while flowing on towards Teddington; and for a brief period it might be even as much as 45 per cent. But this would represent "an exceptional demand in an exceptional "season;" and there is reason to believe that the maximum quantity could be taken without injury to the reaches below the intakes. General Scott anticipates that the grand total of the maximum daily supply for 1893, assuming it to be a dry year, will nearly reach 230 million gallons, or about four-fifths of the quantity which the Royal Commissioners of 1867 estimated could be reasonably expected to be obtained for the use of the Metropolis from the whole of the Thames basin extending to the sea. Apparently for this reason Mr. Ritchie states in the departmental report, that "sooner or later, the problem of the whole water supply "arising from the Thames basin must evidently come "prominently forward." The constant supply connects itself somewhat with this question, and the point is debated whether that system leads to waste. The East London Directors, who have established the constant supply throughout the whole of their Metropolitan area, are not able to report very favourably on this head. They are troubled with an immense number of small houses with inferior fittings, which only keep good for a time. The Company test and stamp all taps free of charge; but "everything is sacrificed "for the sake of cheapness." The Directors state that Deacon's waste-water meters have been in use for many years; and a large staff of waste inspectors is also employed. Nevertheless, they have great difficulty in preventing waste. Other Companies, especially the Southwark and Vauxhall and the Lambeth, have a more encouraging experience; the Directors of the latter Company arriving at the conclusion that under ordinary circumstances, "with constant vigilance and inspection," waste can be kept down in constant supply districts, to such an extent as to compare favourably with the results under the intermittent system. The Southwark and Vauxhall Directors give data showing a diminution in the general rate of domestic consumption following the introduction of the constant supply. But there is an obvious necessity for good house-fittings as well as vigilant supervision, aided by Deacon's waste-meters.

More than 59,000 million gallons of water were supplied to London and its environs last year by the Metropolitan Water Companies. General Scott observes that "the continuous "distribution of this enormous quantity to a population "averaging nearly 5½ million persons, without difficulty or "interruption, is a remarkable fact, and one which is suggestive of able management and good organization." The Thames furnishes a little more than half the total; the Lea exceeds a third; while springs and wells provide 13½ per cent. In 1884 the supply from the last-named source was very little more than 11 per cent. It is explained that the wells which

belong to the New River Company are only brought into full use during the summer months, when the demand for water is greatest. By this plan the cost of pumping is kept down. It is further stated that wells constitute at present the only available resource of the New River and East London Companies for meeting the increased demand for water within their districts. For this reason we are told there will probably be in the future a more rapid development of this source of supply, subject, of course, to the objection already stated, that the River Lea may suffer consequential damage. Notwithstanding the immensity of the total supply furnished by the Metropolitan Companies last year, it was considerably less than in 1887, although accompanied by an increase of 92,000 in the average population. The decrease in the daily supply exceeded 1,366,000 gallons. The rate of increase in the population supplied has been falling off each year since 1884. There was a great leap upwards in 1881, when the increase was 178,000, or not very much less than double the growth in 1888. The daily supply of water per head last year was less than in any year during the past decade, though there can be no doubt an ample supply was given. The cause is evidently that to which we have referred on former occasions—the prevention of waste in connection with the constant supply. In 1879 the Southwark and Vauxhall Company gave above 41 gallons per head daily; whereas last year they supplied less than 28½ gallons. The Lambeth dropped from 37 gallons in 1881, to 28 gallons in 1888. The East London, which gave 38 gallons in 1881, gave 33 gallons last year. A recent increase of one gallon per head daily in the East London supply may be attributed to the peculiar difficulties encountered in that district in regard to waste, as already mentioned. Economy in the distribution of water is especially important, now that the source is being so heavily drawn upon. Concerning the declining rate of increase in the population, it is worthy of note that the district of the New River Company is exempt from that result; the increase last year being greater than in 1887. The Southwark and Vauxhall district exhibits only a nominal decline in the rate of progress; but the abatement is conspicuous in the districts of the Chelsea, Grand Junction, and Kent Companies.

Dr. Frankland's report on the water supply of London in 1888 was discussed in these columns when it appeared in April last. It was then addressed to the Registrar-General; and now figures in the Local Government Board report as addressed to the President of that Department. To avoid repetition, we pass on to the report of Mr. Allen Stoneham, the Auditor appointed under the Metropolis Water Act, 1871. Taking the eight Water Companies in the aggregate, the net increase in their water-rental last year compares rather unfavourably with the increase in 1887; being £11,498, in place of £40,813. But in 1885 things were worse; the increase over 1884 being as little as £6457. Last year the only actual decrease was in the case of the West Middlesex Company, where the decline was £7109. Mr. Stoneham mentions that the Directors of this Company are still continuing to make a rateable reduction in their charges to the consumer. According to his ruling, as reported during last year, the powers exercised by the Directors for the payment of back dividends are exhausted. The Directors do not agree with the Auditor in his interpretation of the law; but they have yielded the point, and the consumers are reaping the benefit. A more recent difficulty has been with reference to the enlarged payments to be made to the Thames Conservators in respect of an increased supply of water to be drawn from the Thames. The increase in the case of the West Middlesex and Chelsea Companies exceeded the limits prescribed by statute; the excess amounting to 4½ million gallons daily on the part of the West Middlesex, and 2 millions in respect of the Chelsea Company. The Auditor "had great hesitation" in passing payments under such conditions. Arbitration was invoked; and the decision being in favour of the extra payment, the scruples of the Auditor were satisfied. It will be seen, by our report of the half-yearly meeting of the West Middlesex Company held last week, that a new reservoir of great capacity has just been finished, intended for the supply of the large population forming in that part of the Company's district situated around Willesden. In addition to the information contained in the Local Government Board report respecting the finances and statistics of the Metropolitan Water Companies, we may refer the reader to Mr. Lass's yearly "Analysis," which completes the record by the amplitude of its details. General Scott states that the form he has adopted for one of his tables is that of one published by Mr. Lass. It is in the comparison of years that the statistical portion of the Blue-Book is more especially serviceable; but in minuteness of examination Mr. Lass is pre-eminent.

Essays, Commentaries, and Reviews.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 936.)

The past week was a short one (the Stock Exchange having been closed on Lord Mayor's Day, owing to the interruption to business), and it was not a particularly merry one. Business grew quieter and duller every day, and no one seemed disposed to speculate. Prices, on the whole, have not suffered as much as might have been expected; though some have been specially affected by that disquieting factor, apprehension of further strikes. The Money Market continues quite easy; and the alarmists are still all wrong. In the Gas Department there has been some slight reaction from the advance effected the previous week; while, on the other hand, some stocks which receded then have now advanced, and others which had wholly or almost wholly enjoyed immunity from the general attack made upon gas securities, have now been objects of aggression. Of the first category, Gaslight "A" is a conspicuous example. It opened on Monday at 251 (but that was the best mark of the week); and, receding very gradually, it was done at 246 on Friday. The 10 per cent. preferences are, however, better; and a small advance in quotation is marked in each. South Metropolitans too have improved; and the "B" (which rose 1½ on Monday) changed hands more than once during the week at top price. Commercials had their turn to be "beared" come last week; and, by able and judicious tactics, the old stock has been knocked down 7½. If there is one of the three Metropolitan Companies which has less than the others to apprehend from the competition of electricity it is the Commercial, which does a snug business in the poorest part of London, where people cannot afford the costly luxury of electric lights. So, to those who are looking to invest money at good rates of return, we say: "Watch Commercials." Depression has extended to Suburbans and Provincials; Brentford old having fallen 3, and Alliance and Dublin and British, 1 each. Of the Foreign division, Imperial Continental has been very active; and though prices have fluctuated somewhat, it has so far resisted all attempts to run it down. Europeans are a little lower; but the rest are fairly steady. In Water, the feature is the announcement of an improved dividend in Lambeth for the half year ended at Michaelmas; being 9½ per cent., as against a previous 9 per cent. The market has been extremely quiet; and there is hardly any change. Lambeths are slightly higher; but Southwark ordinary is down 4.

The daily operations were: Moderate business in Gaslights and Imperial Continental on Monday, at steady figures. South Metropolitan "B" rose 1½. Rather less doing in Gas on Tuesday, and a general drop in prices. Brentford old fell 3; Commercial old, 2½; Gaslight "A," British, and Alliance, 1 each; European, ½; and ditto (£5 paid), ¼. Wednesday's dealings were nearly all in the Metropolitan issues; and Gaslight 10 per cents. rose. Thursday's business was largely in Gaslight "A" and Imperial Continental, at fair prices, and quotations remained unchanged. On Friday there was less activity, and prices gave way—Gaslight "A" receding 1; and Commercial old, 5.

ELECTRIC LIGHTING MEMORANDA.

OVERHEAD WIRES IN NEW YORK—THE INSTITUTION OF ELECTRICAL ENGINEERS—THE AFFAIRS OF THE SWAN COMPANY—ANOTHER SYSTEM OF ELECTRICAL DISTRIBUTION.

There is apparently little else talked of in New York just now besides the dangers of overhead electric wires. The fright that is being manifested with regard to these wires, and the bitterness of the newspapers respecting the conduct of electricians in sacrificing life and property to their own greed for gain, naturally appear unreasonable to the victims of this sudden revolt of popular feeling. It ought to be a lesson to them and others in the United States and elsewhere. The very people who are now hooting the electricians, once hailed them as colleagues in the pleasing duty of stoning the gas companies. Nemesis has come upon the poor electricians so overwhelmingly, however, that those who have opposed them all along may spare a little pity for them now. They simply shut their eyes to the essential character of the popular favour which gave them their first opportunity. It cannot be denied that there has been much of late to turn the public against the electricians. The refusal of the latter to obey the order to put their wires underground, was persisted in with a degree of obstinacy that amounted to insolence; but this conduct would not have alienated the sympathies of a free-and-easy public, if circumstances had not conspired to make the wisdom of the order as conspicuous as the bad faith of the electric light companies in trying to avoid compliance with it. Whether because some of the lines have grown old and weak, or for some other reason, it is a fact that deaths have followed deaths with alarming frequency of late, until it is reckoned that 100 people have been killed in New York City alone by misdirected electrical currents. Since the telegraph lineman Feeks was killed and slowly roasted in the air near the Mayor's office, a similar "accident" has happened to a horse and

driver. The horse was killed, and the driver and two policemen who went to his assistance were severely injured. Mr. Edison has improved the occasion by declaring that "there is no known insulation which will confine these high-tension currents for more than a limited period." This looks bad for the Deptford speculation; and it is unfortunate for Mr. W. H. Preece that his recent declarations on the subject of the harmlessness of electric lighting currents have received such speedy contradiction.

The Institution of Electrical Engineers held their first annual dinner on Monday last week, when Sir W. Thomson presided, and the affair had the splendid advertisement of the countenance and presence of the Marquis of Salisbury. Other guests were the Astronomer-Royal, the President of the Institution of Civil Engineers, the President of the Iron and Steel Institute, and, in short, a host of well-known leaders in science and industry. It is melancholy to read a report of the proceedings and compare them with what the men who represent the associated gas engineers could produce in the same way. It was a brilliant and successful evening; and there is no need to wonder that people think, from such evidence as this, of electrical science as a triumph of the age. The Institution of Electrical Engineers contains nearly 1700 members, although it is not a year old. Of course, not all the members are concerned with the lighting industry—the majority being probably telegraphists; but the Institution is evidently in good hands, and comprises the best men of the profession with which it is identified.

The seventh annual meeting of the Swan United Electric Light Company is to be held on Thursday. The Directors' report states that, after paying all current charges and making ample allowance for depreciation of plant, there remains a credit balance on the year's trading account of £21,042, to which must be added the credit balance of £10,052 brought forward from the last accounts; making a total of £31,094. The Directors will recommend the shareholders a 6 per cent. dividend, which will absorb £22,208. This profit has been made almost entirely out of incandescent lamps. It is curious that the litigation between the Swan and Edison Companies still drags on in Germany, in which country the delays of the law must be something extraordinary even in the eyes of experienced English litigants. By the way, as some of these electric light companies have been at law upon nearly the same points in all civilized countries, it would be within the power of their directors or managers to publish a memoir showing in which land law is dearest and justice most difficult to obtain. That law and justice are cheap and easy to get anywhere is beyond human belief; but some countries must be worse than others in this respect. To return to the fortunes of the Swan Company, however, they must settle their German litigation before they can tell what are their prospects in that country. There is a French concessionary company which seems to be doing fairly well; but more particulars will perhaps be forthcoming at the meeting. In Mr. J. S. Forbes and Major Flood-Page the Company have a pair of well-known men of business to look after their interests; and now that they have dropped lighting and taken to lamp making only, the concern may be thought to have definitely "turned the corner," and got fairly on the way of prosperity.

One has heard of the small-wire distributing system which is supposed to be such an advantage in alternating transformer plants, and there are two-wire and three-wire systems of distribution in use with low-tension currents. Quite recently, however, we learn from Messrs. Laing, Wharton, and Down, the English agents for the Thomson-Houston Company, that during the last two years this Company have adopted for small towns a system of distribution which entails the use of five wires, and still is economical! It is exceedingly difficult for a non-expert to understand the reason of these things; but it appears that the five-wire system is employed in connection with what is called a compensation system, which has an initial tension of 300 volts, and the current at the "distribution transforming compensation" is split up into four circuits so as to give 75-volt lamps. It is therefore a five-wire alternating system of distribution, and is claimed to be worked out most perfectly in all details, giving excellent results. What it is all coming to we cannot pretend to say, except that the electricians seem to be growing mortally afraid of the high-potential currents to which Mr. Ferranti is committed, and are seeking all likely (and unlikely) means of handling alternating currents with safety to life and property.

Mr. Basil Pym Ellis, whose name is familiar to many of our readers as a member of the firm of Messrs. John Aird and Sons, has been nominated a Lieutenant of the City of London.

In the place of Messrs. Carl van Beek and C. Ruping, who have resigned their seats on the Board of the Johannesburg Water-Works, Estate, and Exploration Company, Limited, Messrs. H. J. Barnato, J. M. Marks, and S. B. Joel have been appointed London Directors.

Messrs. R. and J. Dempster, of Newton Heath, Manchester, have in hand an order for the manufacture and erection of a sulphate plant of a capacity to deal with 90,000 gallons of liquor per day. The stills have been specially designed; and the saturators will be made of pure copper. The fishing of the salts will be done by a patent arrangement of a crab with tray, capable of lifting half a ton of salt each time.

THE QUESTION OF FUEL GAS.

It is worth while, just at the present time, to watch what is being done in the United States in the direction of the production of fuel gas, upon which two papers were read at the recent meeting of the American Gaslight Association. This is a subject to which a great deal of attention is at present being directed by American engineers; and it is only reasonable to suppose that they have some special reason for what they are doing, and expect to attain some ultimate benefit from their studies. As a matter of fact, we believe that the supply of fuel gas, as a business, is purely "in the air" at present. There are plenty of "processes" intended for the manufacture of gas primarily for use as fuel; but if there are half-a-dozen fuel-gas supplying companies in existence, we have not been apprised of the fact. The movement has grown out of the "natural gas" business; and what a British gas engineer would, as a matter of course, wish to know, is the extent of the modifications, if any, which have arisen in the States to render that practicable which has been regarded by common consent as impracticable in this country. The talk of fuel gas is not new in English ears. We are quite used to hearing platform orators speak vaguely, but confidently, of the "cheap heating gas" which English gas companies could distribute, if need were, in place of the more costly commodity in which they deal; but experts know how baseless all such talk is in reality. They know that unless such a gas is to be distributed under pressure, the cost of mains, gasholders, meters, management, and capital would be as heavy for it, however poor, as for the really useful coal gas; and that the manufacturing plant would not cost much less. And it is outside the range of probability that mechanical compression could be resorted to with a view to reduce the bulk of the so-called cheap gas. People who talk about cheap heating gas for town use do not appreciate the fundamental difference between the production of a gas for consumption on the spot, and for distribution over a wide area. Yet they might learn something on this point by comparing the selling prices of coal gas in a scattered district and a populous centre. How is it that coal gas of the same quality is half as dear again in Dublin as in Sheffield? For one reason, because the Dublin district is one of the most scattered in the kingdom; while that of Sheffield is one of the most compact. Newcastle-upon-Tyne and Plymouth are other examples of compact districts for gas supply, and also of cheap gas. These are points that the average unskilled critic of gas supply does not comprehend; although he might experience less difficulty in realizing that a railway through a densely populated country may carry passengers more cheaply and make heavier profits than one in a desolate region. Over and over again it has been demonstrated on this side of the water, that it would not pay to distribute any gas of less intrinsic value than coal gas, because of the standing charges which any undertaking of the kind would have to bear; yet the very same problem appears to be talked of in the United States as though it were susceptible of a different solution. No wonder, then, that the discussion is found to be so interesting.

Have we been all wrong in this matter? and is fuel gas really worth distributing in towns as coal gas is distributed? The answer depends in a measure upon what we mean by the term "fuel gas." The most familiar product of the kind which has been experimented with in England is that made by the incomplete combustion of anthracite coal or coke with as much steam as can be added without extinguishing the fire, as in the Dowson apparatus. This producer gas contains a great proportion of nitrogen; and is so weak a fuel that it has never been satisfactorily proved to be worth making for general purposes. A stronger, less bulky fuel is preferable. This means water gas; but water gas can only be made at a great sacrifice of the raw material. The coal or coke employed has to be "blown up" into a state of high incandescence by an air-blast, in the course of which operation some of it is burnt; and then steam is decomposed by the glowing fuel, with the result of the transference of some of its heating power into the form of a combustible gas. The loss in the process of conversion is, however, considerable. There is not only the sensible loss of heat in the cupola, but three-fourths of the carbon is blown away or absorbed in the producer gas made while the air-blast is turned on, and only the balance goes into the water gas. The experimenter is thus placed in a difficulty. If he saves the gaseous product of the blowing-up stage, it is only a weak combustible, too poor to ignite cold. On the other hand, it holds a great proportion of the carbon of the coal, which it seems, and is, a pity to waste. If he mixes the producer and the water gases together, he simply degrades the latter more than he improves the former; rendering the one unfit for uses to which it might otherwise be adapted without qualifying the whole mixture to take its place. There is no getting out of this dilemma while the experimentalist confines his attention to the coke and anthracite coal with which Dowson generators and water-gas apparatus generally are worked.

Finding his water gas from hard coal too wasteful, and his producer gas too good to throw away, yet too poor to sell, the experimenter in fuel gas has perforce turned to bituminous coal, hoping that its hydrocarbons may prove as useful to him as they are to the illuminating coal gas maker. Consequently all the distinctively fuel gas processes of recent origin deal with bituminous coal. They may be divided for the purpose of discussion into two classes—the first including all those arrangements in which the raw coal is fed direct into the generator which it only leaves in the forms of gas and ashes; the second comprising those

in which the coal is carbonized separately, more or less according to the ordinary fashion of coal-gas manufacture, as a preliminary to complete gasification. The Loomis process is a good example of the first class of these appliances; while the other refers to a variety of designs in which a gas-retort discharges its coke into a gas-generator or cupola. The idea of all is the same—the enrichment of the water gas, or of a mixture of the water and producer gases contributed by the coke, by means of the hydrocarbon gases distilled from the coal. It does not really affect the principle whether the coal retort is horizontal or inclined, or whether the coal gas is taken off separately, or the coal merely roasted in a current of hot water gas. The grand object is to obtain all the gaseous combustibles with the least possible loss.

Here, however, there is nearly, if not quite, as much waste as in the hard-coal systems. The coal, having given up its gas in the carbonizing stage of the process, becomes coke, which must be subjected to an air-blast before it will make water gas. Here appears the old waste. What is to be done with the producer gas? Some of it may be used for heating the retorts, boilers, &c., belonging to the apparatus. But this only disposes of a portion of it; and in any case all the fuel that goes to effect gasification is a debit. We encounter the old difficulty of 75 per cent. of the material put into the generator going to the bad, in the form of producer gas. In other words, besides the coal gas, only 25 per cent. of the resultant coke is utilized; all the rest being wasted. Of course, something may be saved by allowing a proportion of the producer gas to be added to the mixed coal and water gases; but how much of this "letting down" is permissible depends upon the purposes for which the gas is required, and the distance to which it has to be conveyed. If they were consulted on the subject, most consumers would say, "I don't want any nitrogen in mine." And if they are not to have nitrogen, the producer gas must be kept out of the mixture.

It therefore comes to this. The old position with regard to the unsuitability, in a commercial sense, of any possible variety or combination of fuel gases for general distribution is maintained. Neither in the United States nor in England will it pay to make a non-luminous gas for general sale. Not only does such a gas compare unfavourably with luminous coal gas, which can do all that fuel gas can claim, and more; but it also fails of proof as an economical way of treating coal. Sir Lowthian Bell's statement is perfectly justified, that "solid coal is not likely to be superseded by any factitious gaseous fuel." At the same time, Sir Lowthian Bell admits the possibility of specially made gaseous fuel being useful under exceptional conditions; and so do we. It would not pay to make and carry everywhere; but it might be profitable in some places. A group of factories, for example, might be advantageously served by a single fuel-gas plant; but this is a very much more humble and restricted field than that which some of our American friends think to occupy in this way, to judge by the extent of their preparations. They will have to learn Sir Lowthian Bell's lesson, either from him or from the more costly teacher, experience. "Nothing can be gained, from a calorific point of view, by the proposed gasification of our fuel." This dictum is undoubtedly true; and its truth does not suffer from the consideration that in the arts and in domestic life many applications of fuel exist, in which convenience, cleanliness, and reliability outweigh the mere computation of calorific efficiency. It is in these exceptions to the hard-and-fast rule of calorific value that the openings for gaseous fuel are to be found. Some Americans have been dazzled, by the success of natural gas, into forgetting the conditions under which the distribution of this kind of fuel has been possible—its high compression and calorific value. Unless we greatly err, no artificial fuel gas has yet been made of the same grade as natural gas without sacrificing all the producer gas in the operation. The question arises, therefore, what is the prospect of compressing artificial fuel gas to anything like the average initial pressure of natural gas which may be about 500 lbs. per square inch in the trunk mains, and selling it for a profit at its fair fuel value? Or, if so much compression is given up as unattainable, how otherwise is the distribution to be effected? The distribution of fuel gas was regarded as an impossible dream when the subject was approached from the standpoint of solid fuel and coal gas. These remain; and it does not appear that the dream is brought any nearer to realization through attempts to regard it by the light of natural gas.

LAYING MAINS UNDER WATER.—Several plans for laying mains under water have lately been noticed in our columns. One by Mr. E. L. Abbott was recently described and illustrated in the *Engineering and Building Record*. The plan was adopted in taking a main across the Missouri River. A timber cradle was built from the top of the bank out to deep water; and on it several lengths of pipe were put together, and their joints caulked. Three empty barrels were then attached to each length of pipe, by ropes that were about one foot shorter than the average depth of the water. The forward or river end of the pipe was plugged, a rope was fastened to it, carried across the river, and made fast to the drum of a hoist. All being in readiness, a mule was hitched to the sweep of the hoist, and all but the last set length of pipe was pulled out into the river. More pipe was then jointed on to the shore end of the line, and all was pulled another stage out into the river, and so on until the first pipe laid came to the opposite bank. The barrels floated all the pipe except that which was resting on the timber cradle, where the friction was slight, so that the entire line hung freely, and was easily moved. When the line had been carried across, the ropes were cut, and the pipe settled into position.

GAS APPLIANCES AT THE FOOD AND COOKERY EXHIBITION.

GAS plays a conspicuous part in the Food and Cookery Exhibition which opened at the Agricultural Hall on Monday last week. Indeed, the appliances used in cooking by the ordinary means, with coal and coke fires, are very meagre as compared with the numerous specimens of gas cooking-stoves exhibited. Of late, London has been pretty well worked with cookery lectures; and consumers of gas have had abundant opportunity of satisfying themselves that they possessed a power to grill, bake, roast, fry, and boil, which they little dreamt of. It is due, however, to our leading gas engineers to say that they have spared no expense in experimenting on the adaptation of atmospheric gas to cooking and heating purposes. The problem of how best to mix the two component parts, has for years puzzled the experts of our trade; and although perfection may be said to be attained, advocates of new systems are still rising daily. What is claimed as one of the latest ideas of applying atmospheric gas for heating and cooking purposes is shown by Messrs. Terraneau and Co., of Pall Mall, who, with the aid of one of Cox's patent regulators, so govern the supply of air and gas that the maximum heat is attained without the least particle of smell or fume. Messrs. Terraneau have brought out, at a very low figure, the "Boudoir" heating-stove, the burner of which is merely surrounded with a circular cage, which when enamelled is very attractive. It is also fitted, if required, with appliances for boiling water, and, when necessary, cooking an early breakfast or late supper. A further novelty is the introduction of the "Main" patent gas-fires and cookers, of which we inspected a very varied exhibit. The stoves are manufactured by Messrs. R. and A. Main, of Glasgow. The feature of the "Main" is that every cooker is fitted with a new patent grill of exceptional power for toasting, grilling, and boiling at one and the same time. The interior of the oven is arranged to produce a powerful top heat, so essential for the successful baking of bread, pastry, &c. They are double-cased with non-conductor packing or hot-air chamber as desired. The bars on the top over the burners are made to lift off singly—a very handy arrangement. The "Main" heating-stoves are also worthy of notice. In appearance they are of the usual pattern; but they are provided with a double atmospheric burner which does not fire back. The front is composed of a double fret of iron, between which is a quantity of indestructible fuel, which becomes white hot and gives out an intense heat. These stoves are made in brass, bronze, Victoria bronze, and nickel, besides ordinary cast iron. Messrs. Main undoubtedly make a good show. The next novelty is that of Messrs. J. Galli and Co., of Mill Hill, Leeds, who have introduced a well-made cooking-stove, but with no gas inside. The burners are below the base of the oven, and hot air is therefore diffused to the top, bottom, and sides. When we saw it in action, there was certainly no smell, either inside or outside. An advantage is that hot-water boilers can be attached to any stove, and worked without extra cost of gas. This stove has apparently won "golden opinions," having been awarded the gold medal at the Anglo-Danish Exhibition; but up to the present it has not been very extensively adopted.

We now come to some of the old friends whose appliances have been frequently noticed in the JOURNAL, and who still have the confidence of the market. Messrs. Wright and Co., of Birmingham, have a very fine show of heating and cooking stoves, especially of their "Eureka" cooker. A new thing is the metal gas-fire with mantel-shelf fitted with bevelled plate looking-glass. This stove could be placed against any blank wall, and be made to look cheerful. Messrs. W. Sugg and Co., Limited, of Westminster, make a splendid exhibit; augmenting that at the Brewers' Exhibition, recently noticed, by adding a large number of their cookers—amongst them being the "Roberts," "Métropole," "Charing Cross," "Connaught," &c. In addition to this, the "Bruxelles" hot-plate elicits much admiration, as do the variety of small heating-stoves which also are of service for boiling, &c., on a small scale. In the evening, Messrs. Sugg and Co. demonstrate the practicability of the various stoves by cooking bread and pastry before the public; and the results are highly satisfactory. Messrs. Leoni, of 114, Cannon Street, have repeated their exhibit of the previous weeks, and have made a splendid show of their noted cookers and heaters. There is not, however, anything new, excepting perhaps increased popularity. The same may be said of the fine selection of stoves by Messrs. T. Fletcher and Co., of Warrington, which have recently secured the gold medal at the Paris Exhibition. All of these noted cookers and heaters are severally admired; and very justly so. Messrs. Fletcher's cooking-stoves still maintain their popularity with gas companies, because in their construction there is absolutely nothing to wear out with years of hard service. Amongst the competitors for public favour are the Wilson Engineering Company, who demonstrate, with a marked degree of success, the practicability of their cooking-stoves. Their stoves of all kinds are deserving of popular support; the cookers, grills, &c., being so perfect and well made. A special feature of their latest invention in gas cooking is the "Wilson" patent stove, the advantages of which are as follows:—The chamber consists of a plain rectangular box of strong cast iron, laid with a flooring of fire-clay tiles, and provided optionally with shelves. No gas-burners are permitted within; the heating being entirely extramural, and applied in an original and singularly ingenious manner. The burners are supplied from without with fresh air, which soon becomes heated before reaching the flames. There it meets a baffle-plate, and, mixing with the gas, provides

for complete combustion. An intense heat is thereby generated, which, by convection, circulates completely round the oven through a series of flues or heating chambers, which are contrived by rows of gills being cast upon the outer walls of the oven. All these parts eventually absorb, and then radiate a steady, regular, and absolutely pure heat into the interior of the cooking chamber. The gills, moreover, are protected externally by an asbestos packing, which effectually conserves the heat, and prevents it from radiating outwards. The atmosphere of the kitchen is thus rendered cool and comfortable, in place of being close and oppressive. When the desired temperature has been attained for baking purposes (say 400° Fahr.), the gas may be lowered, and the oven maintained at that degree, for any length of time, with a minimum consumption of fuel. It has been demonstrated that a dinner sufficient for from fifteen to twenty persons can be thoroughly well cooked in this appliance at an estimated cost of only 2d. for gas. On the score of economy, comfort, and cleanliness, it promises to revolutionize domestic cookery, by affording better means for the regulation of heat, absolute freedom from danger by accidental explosions, thorough efficiency of action, and withal perfectly wholesome surroundings. On the day of our visit, Madame Page was giving her cookery lectures, and the Wilson stove was used; the result being that the various dishes came out as the lady wished. In addition to the "Wilson," the gas bakers' oven, pastry oven, and gas roaster were all demonstrated to be of great value to the cooking community. The exhibits of Messrs. H. and C. Davis and Co., of Camberwell, also are worthy of special note. The assortment of artistic heating-stoves become the firm. That with the "trident" burner, producing a continuous flame even when the gas is lowered, is a matter of congratulation by many, especially as it is said to work with a lower pressure than any stove yet made. Their noted hot-air warming-stove with majolica pillars, majolica moulding round, and coloured tiles in panels back and front, is really very effective, and ought to command a large sale.

The remaining exhibits are those which were noticed in connection with the recent Brewers' Exhibition. They consist of the "Champion" Gas-Lamp, shown by the Company; the "Meteor" high-power lamp, of Messrs. Henry Greene and Sons; and the "Stott" burner and governor. With regard to the latter, a new Stott-Thorp reflex sunlight lamp is shown, which prevents the deposit of soot, &c., on the reflecting surface of the cone. In this case, the cone is of white enamel, without any aperture at the top; but when any dust or dirt is deposited, it is speedily burnt off by the gas after being alight a short time. The Stott-Thorp sunlight lamp is effective as compared with ordinary sunlight; and we are glad to know they have already found favour in many public buildings in Manchester, Dublin, and elsewhere.

The remaining features of the Cookery Exhibition to be mentioned are the various exhibits of gas-engines. They practically are the same as at the recent Brewers' Exhibition and consist of the "Stockport" (driving several of Dowling's sausage-making machines), the "British," the "Otto," and the "Griffin." These, one and all, received their share of public appreciation. Further motive power is derived from steam-engines erected by Mr. E. S. Hindley, of Bourton, Dorset, who has a selection of engines, &c., on view. The electric light is produced from dynamos driven by the Hindley engines, and supplies many of the stalls. The Exhibition will remain open till the end of the present week.

Death of Mr. H. Heard, of Leighton Buzzard.—We regret to have to record the death, on the 25th ult., of Mr. Hiram Heard, who for 38 years filled the position of Secretary of the Leighton Buzzard Gas Company.

A New Ventilating Air Propeller.—Among the various appliances which have been devised for removing impure and heated air from engine-rooms, factories, and similar localities, the ventilating air propeller introduced by Mr. Aland, of the Commercial Road, Lambeth, is noteworthy as possessing special points of excellence, the result of many years' continuous study and improvement. It is claimed for this propeller that, as now constructed, it is capable, with a given power, of creating a much stronger blast than similar machines at present in the market; and the claim seems justified by the experience of the numerous factory-owners who have adopted Mr. Aland's invention.

A Novel Electric Lighting Scheme for Brussels.—It may be remembered that the Municipal Council of Brussels lately invited the presentation of schemes for the introduction of the electric light throughout the town. Six firms have submitted their plans, which comprise various well-known systems; but amongst them is one which is novel. This plan, says *Industries*, has been prepared by M. Van Rysselberghe, the inventor of the long-distance telephone system. He proposes to distribute not electric current but hydraulic power, and to generate the current by means of hydraulic motors placed on the premises of the subscribers. The cost of bringing the current from a distance to the point of consumption, in the case of the Théâtre de la Monnaie, enormously increased the total expense of the installation. In this case the current is furnished from the gas-works at Laeken, and the whole installation has cost 180,000 frs., whereas a local plant could have been put up for 20,000 frs. According to M. Van Rysselberghe's project, large pumping-stations would be erected outside Brussels, and water, under a pressure of 750 lbs., would be conveyed by means of various sub-centres, where small local generating plant would be established.

Communicated Article.

THE DIRECTORSHIP OF GAS COMPANIES.

By A Looker-On.

It may be regarded as somewhat heterodox if one ventures to hint that the present system of conducting the affairs of a gas company, by means of a board of directors, a secretary, and a manager, is not all that may be desired. Yet those who follow closely the events that happen in gas circles cannot but have repeatedly noticed, in late years, various matters requiring attention that are inadequately dealt with by the existing staff; and this not necessarily by reason of any personal ignorance or negligence, but on account of defects in organization. How often has it happened that the cumbrous method of sending an official document to the secretary, waiting till the next directors' meeting, receiving a reply more or less filtered through the personality of this official, and perhaps repeating the process two or three times, has allowed opportunity for a slight misunderstanding to burst into a furious quarrel, or for a trifling grievance to become magnified into a deep-seated and lasting discontent. Frequently the matter in dispute is one on which the directors have very little personal knowledge, and their so-called "decision" is very little more than a blind adoption of the recommendations of their officials; in which case the appeal to the board is simply an unnecessary, cumbrous, and unwieldy method of settling a matter that might have been disposed of in an hour or so in the first place. How frequently it happens that the directorate occupy the position of a secret council, altogether out of touch with the consumers. It really would be a good thing if such directors could hold a sort of "at home," in order to make the acquaintance of their principal customers, and thus avoid the suspicion and distrust which seems to attach to the doings of "the board." An instance of this is to be found in the fact that the gas undertaking is always more successful where the directors are selected from the principal and best-respected inhabitants of the district, than where they are comparatively obscure or perhaps live in another town.

Too frequently the selection of a candidate for a directorship is brought forward from motives other than a personal fitness or ability for the office—such as the possession of a considerable amount of stock, or the desire to meet the wishes of a large shareholder. In towns of any size there is always a good selection of candidates amongst the proprietors or managers of important business enterprises. But in small towns, there is a sparseness of the proper material; and a shareholder may be elected whose only qualification is a willingness to serve. When put into office, the incompetent director is not usually satisfied with acting the part of a dummy; and the evidence of his existence on the board is usually furnished by actions of a negative kind. He opposes the outlay of a few hundred pounds on a much-needed extension of plant, with the result that the supply of gas is insufficient during the dark season, or the manager is obliged to resort to temporary expedients of a costly nature. Fully imbued with the idea that his duty is to look after the shareholders' money, he opposes expenditure for repairs that are really necessary; and when the opportunity for liberal but judicious enterprise in the way of purchase of land, special concessions in order to secure a particular line of business, and so forth, arises, it is likely to be lost on account of the over-cautious opposition exhibited by the incompetent director. It is not uncomplimentary to say that directors rarely err on the side of rashness or excessive enterprise; but possibly they may lean too far in the other direction.

The secretary is usually supposed to be merely the servant or mouthpiece of the directors; but, as a matter of fact, he is often, to all intents and purposes, one of them. He is supposed to have no vote; but his influence is practically as good as a casting vote. If he also occupies the post of manager, or otherwise devotes the whole of his time to the service of the company, there is no special objection to this; but where, as is often the case, he simply keeps the register of shareholders and the directors' minute-book, he can scarcely possess much acquaintance with the "ins and outs" of the undertaking, and therefore is not so well qualified to express opinions about it as those who understand it thoroughly. Some of our best-managed undertakings are characterized by the possession of good competent secretaries, who shake down well into their position between the directors on the one hand and the manager on the other. It is advantageous if the secretary possesses, in addition to a sound commercial knowledge of gas matters, some technical acquaintance with the principles of gas combustion, and especially with the appliances by means of which gas is utilized for lighting, heating, cooking, or technical purposes. A competent official is often able, by the exercise of judgment and tact, to smooth away little difficulties and misunderstandings, and generally to facilitate a satisfactory settlement of all matters pertaining to his undertaking.

The duties which might appropriately be discharged by a competent manager—for example, a keen grasp of the various uses to which the gas is applied by the customers, with a view not only to the retaining of existing business, but to extension in every legitimate direction—are those which are specially neglected under the present system of administration.

The directors, secretary, and manager between them may possibly do a little, in a feeble, desultory manner, in the way of pushing the extended use of gas. But a small user of power may puff out his little cloud of steam just by the gas-works' gates from one year's end to another, and yet it is nobody's business to bring

before him the advantages of a gas-engine. The proprietor of a cookshop over the way may possibly prepare hundreds of dinners daily, and yet no one has ever suggested to him the subject of cooking by gas. Matters have certainly improved in this respect lately; but there is still much to be done. There is probably not a gas office in the country, at the present time, where an application for a service to be laid on would be treated with the *nonchalance* and indifference that was not uncommon some twenty or thirty years ago. But yet the efforts in the way of extending gas business seem to be hampered and cramped. There is a spasmodic display of energy on the occasion of a gas exhibition, or a popular lecture; but it subsides as rapidly as it arose. The chief reason of this lethargic dulness is the indifference of the directors. The officials find that any efforts on their part are not apprecaited, and perhaps not backed up by the board. At the same time they are not authorized to take any decided step without consulting the directors. Consequently the retaining and extension of business is left to take care of itself, instead of receiving that careful attention and nursing that is usually bestowed upon it in other commercial undertakings. We have heard that certain large firms retain the services of an advertising agent. If they find it worth their while to do this, surely the gas directorates would do well to see that this department receives proper consideration.

Attention has so far been directed to the commercial side of gas administration; but there is now something to be said about the technical part. In the matter of what is called gas engineering, the directors are entirely in the hands of the gentleman who is usually spoken of as the "manager," but who might be more appropriately distinguished as the "engineer," or, if preferred, "technical manager." If they are not satisfied with the decisions of this official, in regard to the purchase of coals or other material, or to other arrangements in connection with the technical operations, their best plan will be to get a successor, in whom they can place full reliance. It is idle to suppose that the directors, by virtue of intuitive wisdom on their part, can make up for any presumed deficiency, or supplement the practical knowledge of their engineer; yet how often instances are to be met with in which something of the kind is attempted. The engineer reports that certain extensions are urgently necessary; but the directors tacitly refuse to believe him by repeatedly shelving the question, on one pretence or another. In respect to working results, how frequently a gas engineer is handicapped by injudicious purchases conducted by the directors, either contrary to, or without his advice. Especially is this noticeable in regard to coal contracts, which many appear to regard entirely as a matter for the board. The directors can clearly appreciate the difference between coals at 9s. and coals at 10s. per ton, but not very much more; and if the official who is responsible for the working of the materials to the greatest advantage is not able to decide as to those best suited for his purpose, or is not to have a voice in their selection, who is? The directors may be good men of business, and may perhaps have a little insight into technicalities; but it is extremely improbable that they will have so good a knowledge of technical operations, as conducted at their own works, as the individual who has these operations continually before his mind. This point also applies, to some extent, to the commercial questions brought before the directors.

The great defect of the present arrangement is that it enables a director, who may be very scantily informed on the point at issue, to exercise a greater authority than those who are really intimately acquainted with the matter. The permanent salaried officials are selected with care; and any negligence or ignorance on their part is at once evident, and will be dealt with by the directors. But the ill-effects of ignorance or want of judgment on the part of the directorate may frequently escape notice. And if gas companies are to be successfully worked amid the competition that seems to be gradually, though slowly, closing around them, it is necessary that there should be a clear and intelligent comprehension of the whole working, coupled with energy, on the part of the directorate, especially in the development of new business. I need not pass in review the modern forms of enterprise—such as gas exhibitions, either of a temporary character, or permanent in the form of a show-room; the delivery of cookery or other lectures; the allowance of discounts for special lines of business; the letting of stoves, and especially of fittings, on hire. These are generally well known, although so little energy in the way of adopting them is the common experience.

THE Directors of the Lambeth Water Company recommend a dividend at the rate of 9½ per cent. per annum for the half year to Sept. 30 last, on the 10 per cent. maximum dividend shares.

THE Directors of the Buenos Ayres (New) Gas Company, Limited, have declared the usual interim dividend at the rate of 6 per cent. per annum, free of income-tax, for the six months ending June 30 last.

ON the 4th prox., a paper is to be read before the Liverpool Section of the Society of Chemical Industry, on "The Dinsmore Process for the Manufacture of Coal Gas;" the author being Mr. Isaac Carr, of Widnes.

WE have received a copy of the new illustrated price list of chandeliers, brackets, and hall lamps, gas, water, and steam fittings, &c., issued by Messrs. D. Hulett and Co., Limited, of High Holborn, W.C. It is a very comprehensive catalogue, profusely illustrated, and neatly bound; and deserves a place among similar books on the office tables of gas and water engineers.

Technical Record.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Autumnal Meeting of this Association was held at the Grand Hotel, Birmingham, on Thursday, the 17th ult., as recorded in the following issue of the JOURNAL. The PRESIDENT (Mr. Charles Taylor, of Derby) was in the chair; and there was the usual good attendance of members and friends.

CONFIRMATION OF MINUTES.

The HONORARY SECRETARY (Mr. J. S. Reeves, of Bilston) read the minutes of the previous meeting; and they were confirmed.

ELECTION OF MEMBERS.

On the motion of the PRESIDENT, the following gentlemen were unanimously elected members of the Association:—Mr. W. Duesbury, Manager of the Cambridge Gas-Works, and Mr. W. R. Chester, General Engineer and Manager of the Nottingham Corporation Gas-Works.

WATER GAS.

The next business on the *agenda* was the discussion of the interesting paper on the subject of "Water Gas" read by Mr. J. Ferguson Bell, of Stafford, at the last meeting, and which was published in the JOURNALS for May 21 and 28 last (pp. 948, 993).

The PRESIDENT: The paper read by Mr. Bell at our last meeting was a very admirable one, and one which impressed me with the great usefulness of the Association, and for which we should feel grateful to Mr. Bell. I think there is probably very little difference of opinion among the members as to the chances of water gas as against coal gas; yet the paper deserved thorough consideration, and many of the members will no doubt have something to say upon the subject.

Mr. CHARLES HUNT (Birmingham): I am glad to have the opportunity of recognizing the fairness and thoroughness with which Mr. Bell has treated his subject. We have had previous experience of Mr. Bell's ability in the preparation of papers; but on this occasion he has surpassed himself. There is much in his paper to which one may express cordial agreement; for instance, with regard to the calorific value of water gas, as compared with that of coal gas. What he has said upon this point must be felt by all to be practically incontestable; nor am I for one prepared to challenge the correctness of his views as to the present impracticability of economically distributing what is known as fuel gas. At the same time there may be two sides to the question he has placed before us; and it is just as well that both should be heard. While, for instance, the distribution of fuel gas as distinguished from illuminating gas, may still be with us a dream of the future—whatever it may be in America—it does appear possible that under favourable conditions manufacturers may find it to their advantage to make and use water gas, even supposing that the recently introduced method for the complete conversion of soft coal into a strong fuel gas should not prove the success that is claimed for it. Nor need such an innovation be regarded as antagonistic to the coal gas industry, since every fresh application of gaseous fuel must tend indirectly to its advantage, by the teaching it conveys of the convenience and cleanliness of fuel in the gaseous form. Perhaps, however, we are more immediately interested in the possibility of producing a cheap carburetted water gas, which may either take the place of coal gas, or be worked in conjunction with it. In this connection, Mr. Bell has referred to the water gas industry in America as a decaying one; and instanced a number of companies supplying carburetted water gas at a higher price than is charged for coal gas. I do not think that the selling price of gas in America is to be regarded as at all a safe indication of the profit which is earned. The conditions of gas supply in America are essentially different from those which prevail in this country. Until very recently the price of gas was kept high; so that the companies might, by earning a large profit, "make hay while the sun shines." They were never safe against competition in the event of a new company—whether water gas or coal gas—obtaining legislative sanction. During the last few years, however, a better understanding appears to have arisen. It is becoming more and more difficult to start competing companies; while we now see, not so much the introduction of carburetted water gas companies to compete with coal gas, as the adoption by coal gas companies of water gas plant to work in conjunction with their own. Any one who has followed the course of events in America, as indicated by the reports of the various meetings of the Associations of Gas Engineers and Managers, can hardly fail to be impressed with the increasing amount of attention that is being paid to this question. We must give our American brethren the credit of knowing what they are about; and the figures they publish afford reason for believing that they find it advantageous, where circumstances are favourable, to call in the aid of carburetted water gas. These figures scarcely confirm those of Mr. Bell, who has assumed that naphtha is usually employed in the enricher, whereas crude petroleum is used for this purpose—the gas being made from soft coal or gas coke. The cost in America is thus much less than that which is given by Mr. Bell. One of my correspondents in that country has kindly furnished me with figures, from which I infer that illuminating gas of a very high quality can be produced there at a price very little, if anything in excess of the cost here of coal gas of a much lower illuminating power. If that is so, it seems clear that there

is a distinct future for carburetted water gas in America, whatever may be the case with ourselves. Hitherto crude petroleum has not been imported here—there being no market for it; and we are still in doubt as to the price at which it can be delivered. If, however, it is the fact that the large oil companies on the other side are prepared to go into this question, with the view of delivering the crude material in bulk at the lowest possible rate, who would be bold enough to assert, in face of advancing prices of coal and labour, that this is not a question likely to enter into the regions of practical gas politics. I have not the least wish to pose as the advocate of water gas. All I desire is to preserve an open mind upon the subject, and not lose sight of any possibilities that may present themselves in connection with it. Under present conditions in England, it is admittedly impossible for carburetted water gas to compete with coal gas. But these conditions may change; and we should then be prepared to welcome as an ally that which under no circumstances can we have any occasion to regard as a formidable opponent. It may not be considered out of place if, before sitting down, I refer to the recent visits to America of several of our leading gas engineers upon matters connected with the development of our industry. We have always been accustomed to such visits from our American brethren, whom it is a great pleasure to us to see among us from time to time, and who may always feel assured of a hearty welcome. The visits of English engineers to America are, however, of more rare occurrence. If they were less so, it would certainly be to our advantage, and could not fail to cement the bond of union between the two countries, which, let us hope and believe, is already well-nigh indissoluble.

Mr. J. Tindall (Walsall): I should like to add my testimony to the appreciation of Mr. Bell's paper which has already been expressed. Soon after the paper was read at our last meeting, I was requested by my Committee to report on this subject. To enable me to do so, I had to read what I could find in reference to it; but the statements were so contradictory that no reliance could be placed on them. I did not know anyone in England who has had any experience on the subject, except the late Mr. Spice. I remember hearing the remarks he made about water gas at the meeting of the British Association of Gas Managers, at Leeds, in 1875; and I believe it was at Wormwood Scrubs that he erected plant to supply the Great Western Hotel and some other buildings. For two or three years I think he supplied those places with water gas in conjunction with, or as an auxiliary to, coal gas. He experienced no difficulty in carburetting the gas; but, on the other hand, he found it to be a good carrier of carbon vapour. But the destruction of his apparatus and tubes by the superheating and decomposition of steam, was so great that he was obliged to abandon the process. It seemed to me at that time that the difficulties were so great that water gas was not worth taking notice of. But, as Mr. Hunt has said, I have an open mind on this and other matters—such as the electric light; and I think it is well to keep the matter before us. When we consider that the output of coal in England and Wales is 160 million tons annually, and that it is increasing, we must feel that this enormous output cannot go on for ever. The time will come when that quantity will diminish; and my opinion is that, when the time arrives, it will come upon us suddenly. Then water gas may well be a very useful adjunct to our works. I know it will take coal to make water gas; but in nothing like the same proportion. So far as we are concerned, we have nothing to fear from it. Things change so much, and such improvements come about, that it is well to keep these matters in the front, and not to pooh-pooh them, and think nothing can touch our industry. With regard to patent rights, in the report I prepared for my Committee, I said I believed we could erect plant without paying for any rights at all. I do not know that this is correct; but I took it from Mr. Bell's paper. If water gas can be an advantage to anybody, it should be to gas companies and corporations, who are certainly the proper people to enter into the business.

Mr. J. Annan (Wolverhampton): Speaking for myself, I am exceedingly grateful for the able paper Mr. Bell has read before our Association. I had some experience of water gas 37 years ago; but the present manipulation of this gas is very different from what it was in 1852. In that year I occupied the unsatisfactory position of superintending the erection and the manufacture of the water gas works patented by a Mr. White, three of which were constructed in Scotland. They did not answer; and were soon converted into coal gas works. Since then science has, and is now, making rapid strides; and it seems to me that water gas will come to the front in time. I do not say it will now. I think that Mr. Bell's paper will be beneficial not only to our Association, but to everyone who is connected with gas-works in England and America. His paper will lead us to look up the subject, and see if we cannot make some use even of water gas, and carry out what has been brought forward by Mr. Fox and some others, who have been making use of water gas for different purposes. If I was a younger man with more time to spare than I have, I should like Mr. Bell alongside of me, to make a thorough test of water gas works; and I should not mind even spending a little money over it. The electric light has also made rapid strides, and is coming forward; and we shall have to put our best foot to the front to keep our place between the two. We have, I fear, lost the power of keeping the electric light in our hands; but I believe very much in now keeping water gas before us, if it is at all likely to be of any advantage.

Mr. C. S. Ellery (Bath): I do not like to regard water gas as an opponent, but would rather welcome it as a friend. We have made a large number of experiments with petroleum; and at the present moment, we have a quantity at the works for the purpose. Instead of looking on those who write papers upon, and study the question of water gas and petroleum gas as likely to hinder our success, I rather think they are going to contribute to it. Petroleum is very valuable as a carburetter; but we have not found a suitable carrier. We found it stopped our pipes, and interfered with the free working of the retorts. I hope to hear that water gas is a good carrier for petroleum vapours, from those who have made apparatus for trying it. Probably petroleum will take the place of cannel coal in gas-works.

Mr. Hunt: What price do you pay for petroleum?

Mr. Ellery: I think 6d. to 6½d.; but the price varies for the different oils. If water gas can be produced as a suitable and profitable carrier for petroleum vapours, I do not see why we should not use it. By employing petroleum, we should be taking an opponent over to our side. I understand that in some towns people find oils are sold so cheaply that they use them in preference to coal gas. By converting these oils into gas, we are serving the interests of gas companies and consumers as well. I want to enter my protest against the idea that we are in any fear of water gas; and I prefer to regard it as a possible friend in time of need. Why should not the surplus heat from our retort-house furnaces be utilized to assist in the production of water gas?

Mr. H. Peaty (Burslem): I do not think it has been mentioned what the outlay for these experiments was, and the cost of producing water gas. The chief use of water gas has been mentioned by Mr. H. E. Jones, who, after a visit to the United States, said it would be useful in winter, when we are pressed for retort room. It is not said it would be cheaper, taking it all round, or more beneficial. In this discussion, the noxiousness of water gas has been altogether omitted; and nothing has been said as to whether, if we take it as a friend, it will be cheaper. I think we are missing the points in the paper, as Mr. Bell attempted to prove that water gas was dearer, more noxious, and not so good as coal gas, taking it all round.

Mr. Hunt: No doubt the price at which crude petroleum can be obtained is the key of the position. If this could be delivered in London, or anywhere in England, at about 1d. a gallon it might perhaps pay to manufacture carburetted water gas—at least as an auxiliary during the winter months.

Mr. J. F. Bell (Stafford): I thank you for the way you have received my paper. When I entered on this investigation, I did not regard water gas as an enemy, but rather as a friend, and tried to treat the matter as impartially as possible; so as to see if it possessed any advantages over coal gas. I take it, if anyone wished to erect water-gas works they can do so, without going to the Water Gas Syndicate, or anyone else. With reference to America, the price of gas there is almost three times what it is in England. From a paper which has been handed to me recently, I find the ratio is 7 in England to 19 in America. In my paper, I said that coal gas was sold in America at 9s. 6d., and water gas at 10s. 6d. I took those figures from statistics; but, unfortunately, they were not up to date, and I now correct them. I find as a fact that coal and water gas, taking 295 towns, are sold at about 8s. per 1000 cubic feet. There are now 195 towns in which coal gas is supplied, at an average price of $1·95 per 1000 cubic feet; and 100 towns in which water gas is supplied at $1·87 per 1000 cubic feet. So that you may say the prices are practically the same. To make the comparison as fair as possible, I referred to the "Gas and Water Companies' Directory," and took all the towns in England with a population of above 10,000. I find that there are 246 towns in which the average price of coal gas is 3s. per 1000 feet. Now, if water gas can only just hold its own in competition with coal gas at 8s. per 1000 feet in America, how can it compete with coal gas at 3s. per 1000 feet? Mr. Hunt is always happy in any criticisms he makes; and he said a mixture of the two might be made a reality in the future. In my paper, I said it might be so some day; but at the present time it is not practicable. Then reference has been made to the increase of water gas plants in America. Well, I can quite understand that in places in America where at times they have great troubles with their workmen, and certain other things to contend with, it may be an advantage to have a water gas generator, and use it to tide over certain difficulties. In England it is quite possible that we may put down water gas plant to help us to tide over a difficulty; but I say it is impossible to make water gas to compete with coal gas at the present time. Why? Water gas contains 300 units of heat, and coal gas 660 or 670. The British Water Gas Syndicate and others assert it is entirely due to ignorance that gas managers have not adopted water gas; and they are perhaps annoyed that gas managers have not advised their Boards to do so. I say it is more economical to make coal gas in retorts than to make the water gas—as now proposed. We will take coal gas with coal at an average price of 10s. per ton, and from which 10,000 cubic feet of gas are obtained, which gives 1s. per 1000 cubic feet. But we produce residuals to the value of 9·4d. (I am taking my own case); and that leaves the price only 2·6d., or (say) 3d. per 1000 cubic feet for the raw material. Take water gas. We find the cost of the raw material will come to 3½d. per 1000 cubic feet, or ½d. more; and that for only half the amount of heat. Then, coming to the question of carburetting, Mr. Hunt says that if petroleum can be delivered at 1d. per gallon, it would pay to carburet it. But at this low price, it would cost 5d. for carburetting;

while the gas I supply (which is of 17-candle illuminating power) only costs me 3d.

Mr. HUNT: But this is 22-candle gas.

Mr. BELL: It would be more then. I am amazed at Mr. Ellery using petroleum at 6½d. per gallon; as that would come to 2s. 2d. per 1000 cubic feet.

Mr. ELLERY: That was for experiments.

Mr. BELL: It costs as much according to your experiments as you would want to sell the gas for. Then I take another standpoint. I say it is more scientific for gas engineers to make coal gas in closed retorts, when we require to use it for illuminating purposes, than to manufacture it as the water gas people want us to. Take a ton of coal. We obtain 10,000 feet of gas from it; and each cubic foot yields, on complete combustion, 670 British thermal units, or 6,700,000 B.T. units for the 10,000 cubic feet. We also have at least 10 cwt. of coke for sale, with a calorific value of about 13 million heat units, which gives a total of about 20 million B.T. units from the ton of coal, without taking into account the tar and ammonia. Now, according to the water gas people, we can get 34,000 cubic feet of water gas per ton of hard coal, with a thermal value of 300 B.T. units per cubic foot, or a total of something above 10 million heat units. To get this we are obliged to produce 120,000 cubic feet of producer gas, as it is now dubbed, which contains at least 70 per cent. of nitrogen; and this gas, bear in mind, is of little use. Surely, with all the sophistry, it cannot be very scientific to waste—for this is what it means—one-half the calorific value of the coal used, in order to convert it into water gas. Before any gas engineer starts to make water gas, he should read Sir Lowthian Bell's paper on "Gaseous Fuel" which appeared in most of the technical journals.* It will show that people need to be careful before they spend a lot of money on water gas plant. The Water Gas Syndicate in the pamphlet which they issued, say that we could supply water gas uncarburetted. Well, we should have to use magnesian comb burners; and people would not trouble to use the gas in that way. In America the lowest price they charge for uncarburetted water gas is 50 cents per 1000 cubic feet. Coal gas of twice the heating power is sold here at from 1s. 9d. to 3s. per 1000 cubic feet; and in America at from $1 to $2½. In England it might be possible to distribute water gas for heating purposes alone, if use could be found for the bulky producer gas; but I do not see that it is possible to distribute carburetted water gas, on account of the cost of carburetting. I entered on this question because I thought it the duty of gas engineers to go into any matter affecting them, especially when they heard it stated that they were afraid of water gas. I reiterate that exaggerated statements have been made regarding water gas. For example, the most prominent advocates of water gas get up and say that 25 per cent. of the gas made leaks away in internal fittings. Such a statement is absurd. I find we send four times as much gas out in January as in June; and if 25 per cent. of the gas is lost by leakage, people would not be using any in June; but only paying for leakage. (Laughter.) Then there is the question of the suitability of the gas. Carbonic oxide is a deadly poison; and water gas must therefore be more deadly than coal gas. Mr. Fox asserts that 25 per cent. of the gas made escapes; and if that is so, it would be a risky thing to distribute water gas, which is seven times more dangerous than coal gas. As to the price, the Syndicate people say that water gas can be produced for 4d. per 1000 cubic feet. It was stated at the Iron and Steel Institute meeting held in Paris that it can be made for 6d. Another authority says 1s. 1d.; and a little more experience would no doubt bring it up to our figures. Mr. Tindall referred to the output of coal which is going on. When the coal is exhausted, I am sure even then we cannot make water gas. Mr. Annan says he has erected three water gas works, and that they have been failures. When Mr. Annan gets burnt, he seems to be like the moth, that goes back to the candle, and tries it again. He says he is willing to find money for experiments; and I commend the water gas people to him. Mr. Peaty hit the nail on the head when he said it was a matter of "£ s. d." So it is. If we could make water gas cheaper than coal gas, the thing would be entirely different; but I find that its cost is higher. It is more poisonous; and what advantage can there be in substituting it for coal gas?

SOME OF THE CAUSES OF UNACCOUNTED-FOR GAS.

The paper on this subject prepared for the previous meeting by Mr. W. T. Tew, of Warwick, but which, owing to shortness of time, was taken as read, was next discussed. Though the paper has already been published,† by the desire of the members the author read it before the discussion commenced.

The PRESIDENT: This is a question which enters into the circumstances of our management day by day; and, in my opinion, is a very important one. If my friend Mr. Chester had been here, he could, I think, have given us some valuable information on the loss in volume by the difference of temperature between the station meter and the consumers' meters in Nottingham. Perhaps other gentlemen will give their experience in this direction. In my own case, the station meters are situated close to the purifiers; and no doubt the reduction of volume goes on to which Mr. Tew refers. I should like to know what the results are in cases where the station meters are placed at a distance, and where opposite conditions to those referred to by Mr. Tew obtain.

Mr. H. TAPLAY (Stoke-upon-Trent): I must rather disagree with Mr. Tew that the difference in temperature explains much of the unaccounted-for gas. A dry meter may be put in a passage, and a north-east wind may blow, but people do not keep their doors open all day; and I do not think that when gas is settled in the holder you will get it at above 35° during the sharp weather spoken of. I think it is rather a benefit to have the meter in the house. The temperature of the gas should not go down low, even in a cellar. For illustration, take a three-light meter, passing 15 cubic feet an hour. A dry meter makes between nine and ten revolutions for every foot of gas; being in round numbers 150 revolutions an hour for three burners. That is nearly three revolutions per minute. When gas is passing at this rate, I do not think the outside temperature can make much, if any, difference. There is no refrigerator in the meter. Supposing the temperature is below 30° in the cellar, it should be borne in mind that there is only one portion of the gas exposed; the gas within the disc is not. Therefore, only one-half of the gas is under the influence (if at all) of the temperature of the cellar, or any other ordinary position. We must therefore look for other causes. Parliament says at no time of the day shall we deliver gas under less than 6-10ths pressure, and at night-time under 1 inch pressure; and the same wise people say the meter shall not be tested at above 5-10ths pressure for registration. We can see from that there must be some discrepancy in the meters at the works and at the consumers' premises. A meter tested at 5-10ths pressure, if tested at the normal pressure of the district, must vary; and in some districts where there is 3 or 4 inches pressure, there must be more gas passed for a cubic foot than where it is 5-10ths. A dry meter must of necessity pass more gas; inasmuch as there is a flexible leather in the meter, and that must naturally become more full. We must also look for unaccounted-for gas in other ways. It is my custom to take off regularly (when I have a man to spare during the summer) the dry meters and bring them to the works for testing; and my experience shows that many of the larger meters pass gas without registration. I started with the larger meters, and found some would pass 75 feet per hour, and not a foot was registered. I went round the district, and discovered non-registration varying from that amount to 10 per cent. slow. Invariably dry meters of the larger size would pass one or two lights without any registration. I have adopted the plan of periodically testing the dry meters; and if anyone will try it who has not done so already, he will find quite 10 per cent. of the meters will be wrong. Those who test them periodically, I have no doubt, will bear me out in what I say. We may look for the difference for unaccounted-for gas between large and small works, more as due, not to temperature and pressures of holders, but to the consumption per mile of main. There may be unaccounted-for gas through leakage or bad management; but you must take the consumption of gas per mile of main into account. At Stoke-upon-Trent, I have in eight years brought down our unaccounted-for gas from 21½ to 6½ per cent.

Mr. T. LAYTON (Redditch): I live in a manufacturing town, and sometimes in the daytime have discovered errors in these large dry meters. I have no doubt there is a considerable amount of unaccounted-for gas in this respect. Mr. Tew said something about the effect of keeping meters in the cellar, which I find is not very different to a position under a shop window. The cellar is not always the worst place for the meter; and the way Mr. Tew has explained the matter quite tallies with my own experience. The question of the consumption on a length of main is an important point, and one which, I think, we have to consider. As to evaporation, in some places we have not been able to supply wet meters, and had to put in dry ones.

Mr. C. MEIKLEJOHN (Oldbury): The difference between the gas made and sold must always remain an unknown quantity. As to the temperature of gas in underground mains, I made some experiments on that point, and found it very uniform. There was only a difference of 2°; while there was a variation in the atmosphere of something like 9°. I think, by taking the weekly temperature of gas in the mains, we may obtain something like a standard of comparison between the registration of gas at the station meter and the consumers' meters. It is my intention to fix thermometers in a few selected large meters, and find out what takes place in a lengthened period. I agree with Mr. Taplay, that there is more gas lost from neglected meters than many of us are aware of. I went some time ago to a small town where they had a leakage account of 23 per cent. It occurred to me that there had been a serious neglect of the meters. I had them brought in, and discovered that some of them were nearly 60 per cent. slow. They were all dry meters. After 18 months, the leakage was reduced to 14 per cent. All the other conditions were the same; but the loss was reduced from 23 to 14 per cent. I should be glad at some future time to lay before the Association what I find to be the average temperature in the mains, the consumers' meters, and the station meters.

Mr. TEW: I thank you for the way in which you have received my paper. I can only repeat, with regard to what Mr. Meiklejohn says, that gas is very susceptible to change of temperature. I have had a number of meters frozen in frosty weather; and if 10 per cent. are frozen, we must conclude they are colder than the station meters. Mr. Taplay spoke of the influence of pressure. I can assure him that 6 inches of water is equal to a difference of 1¾ per cent. in a volume of gas. In respect to the meters, it is known to all members of the gas profession that dry meters are often very incorrect; and I should certainly assume that Mr. Taplay's meters are dry ones.

* See *ante*., pp. 699, 747. † JOURNAL, Vol. LIII., p. 950.

Mr. TAPLAY: Those I tested were dry ones.

Mr. TEW: Dry meters, besides working slowly, sometimes register fast, and that would counteract the slowness of the others. Mr. Meiklejohn's experience is contrary to mine, but that does not call for reply. I again thank you for the way in which you have received my paper.

ELECTION OF PRESIDENT AND OFFICE-BEARERS.

The PRESIDENT: I have great pleasure in proposing that Mr. Peaty be elected President of the Association for the ensuing year. It is quite unnecessary I should make any remarks upon Mr. Peaty's fitness for this position. I have found him always ready to enter into our discussions, and assist us in every possible way. I believe we shall find him an excellent President.

Mr. TAPLAY said he had pleasure in seconding the proposal. They had known Mr. Peaty ever since he had been in North Staffordshire, and knew him to be a gentleman of ability and intelligence, and of high literary attainments. He did not think a better choice could be made.

Mr. W. NORTH (Stourbridge) supported the resolution, and said there had been a tacit understanding for some years that North Staffordshire should be represented by one of the gentlemen connected with the gas undertakings in that district. He believed Mr. Peaty would have the support of every member of the Association.

The motion was carried with applause.

Mr. PEATY: I thank you very much for the high honour you have conferred on me; but I think it would have been quite within your power to have chosen a better man for the office. You have thought fit to couple my name with the district I come from; and I know I shall have the support of all the members in that district. I shall do my best to represent that district and the Association to your satisfaction. It is not so long since Mr. Darwin was taken away; and I can only wish he had lived to represent the district instead of me.

Mr. TINDALL proposed the re-election of Mr. Simpson, of Rugby, as Treasurer, and said they had in him a gentleman who would look after the money for them, and whom they could rely on as a good adviser.

Mr. B. W. SMITH seconded the motion; and it was carried.

Mr. SIMPSON: I am much obliged to you for the honour you have again conferred upon me. Anything I can do for the Association, you know perfectly well you have only to ask of me, and I will do what I can.

The PRESIDENT said they were very much indebted to Mr. Reeves for his services as Honorary Secretary; and he had much pleasure in proposing his re-election.

Mr. J. WARD (Brierley Hill) seconded the motion; and it was carried.

Mr. W. NORTH proposed the election of Mr. Hunt as a member of the Committee in place of one of the retiring members.

Mr. R. O. PATERSON (Cheltenham) seconded the motion, which was carried.

On the motion of Mr. TAPLAY, seconded by Mr. SMITH, Mr. J. Deakes was also elected a member of the Committee.

Messrs. Tew and J. T. Lewis were next appointed Auditors, on the motion of Mr. SMITH, seconded by Mr. W. NORTH.

VOTES OF THANKS.

Mr. HUNT proposed a vote of thanks to the retiring President for the admirable manner in which he had discharged the duties of his office in the past year. Mr. Taylor had earned the esteem of every member of the Association by his unfailing courtesy, and the able way in which he had presided over their meetings. He had had the misfortune to miss the meeting at Derby and Matlock. But he knew what an enjoyable and successful one it was; and he need not say how greatly Mr. Taylor contributed to its proving so. In retiring from the presidency, he would carry with him the esteem of every member of the Association, and their warm wishes for his future happiness and prosperity.

Mr. PATERSON said he cordially seconded the vote of thanks to the retiring President. There could only be one opinion about Mr. Taylor's services; and he had not disappointed them in the expectations they had formed of him. It must be a gratification to him on his retirement from the chair to feel that he had not only retained, but increased their respect for him.

The motion was carried with acclamation.

The PRESIDENT: I do not know what I can say to adequately express to you my thanks for your kind feelings towards me, and for your kind expressions. I felt grave doubts at the outset whether I should be able satisfactorily to fulfil the duties you asked me to undertake; and I do not think I could have done so but for the kind way in which the members of the Association have assisted me. My year of office has been to me a year of very great pleasure, because I have felt your kindness would interpret for the best, and excuse my shortcomings. I sincerely and heartily thank you. I wish to now propose a vote of thanks to the Treasurer, Honorary Secretary, Committee, and Auditors for their services in the past year. The members will all agree that these gentlemen deserve our cordial thanks for the admirable way in which they have performed their duties.

Mr. WARD seconded the resolution, which was carried.

Mr. REEVES replied on behalf of the officers, and said it had been a great pleasure to himself personally to be of service to the Association, and no doubt the other officers had felt a similar pleasure in the performance of their duties. They were much obliged for the resolution.

PROPOSED ALTERATION IN THE RULES.

Mr. W. LITTLEWOOD (West Bromwich) gave notice that, at the next meeting, he would move that Rule 2 be altered so as to admit of the annual appointment of a Vice-President.

This concluded the business portion of the proceedings.

VISIT TO THE BIRMINGHAM COMPRESSED AIR COMPANY'S STATION.

The members afterwards drove to the works of the Birmingham Compressed Air Power Company, which, by the kind permission of the Directors, they were allowed to inspect. Many points of interest were explained by the Engineer and Manager of the Company (Mr. J. Sturgeon), who courteously conducted the party over the works. A description of the plant and an account of the work the Company is doing appeared in the JOURNAL for the 22nd ult., p. 785.

The members subsequently dined together at the Grand Hotel.

THE MANUFACTURE AND SUPPLY OF FUEL GAS.

The question of the manufacture and supply of gaseous fuel came before the members of the American Gaslight Association, on the first day of their recent annual meeting in Baltimore, in two papers read respectively by Mr. Walton Clark, of Philadelphia, and Mr. John Young, of Allegheny City. The former gentleman had been selected by the Committee of the Association to introduce the subject; and he did so in a well-prepared paper. Mr. Young's communication was the result of a few thoughts on the matter, induced from his practical experience in the distribution of natural gas. In view of the increased interest which now attaches to the question dealt with in the two papers, we give them in full.

MR. WALTON CLARK'S PAPER.

Within the last few years there has developed a demand for a safe, cleanly, and cheap combustible, suitable for general distribution, applicable to the production of light and power as well as of heat, ready for instant use, requiring no storeage room upon the premises of the consumer, and brought without his aid to the point of combustion. To state the conditions of the demand is to prove a gaseous fuel necessary to their satisfaction, and I understand fuel gas to be such a gas or mixture of gases, luminous or otherwise, as is fitted to fulfil them. What I have to read to you is written with this understanding, which precludes the consideration of local plants for the manufacture of gas to be used on the premises. I confine myself, therefore, to the presentation of my ideas upon the subject of the manufacture and distribution of such gas as I believe will commend itself to our probable customers, and meet the reasonable expectations of profit which our employers may indulge—hoping to show rational ground for "the faith that is in me."

A year and a half ago, I prepared a paper upon this subject for the Western Association.* In it were given the ideas I then held, and now hold, as to the part of the demand for fuel we may hope to supply through pipes from central stations, and the mixture of gases which shall be at once suited to the public need and producible at a figure which shall not prohibit its sale. I now repeat the opinion there expressed, that our operations as fuel vendors will be confined to warming apartments, cooking, supplying light and power, and heating soldering-irons, light forgings, and other implements and materials demanding a small localized fire. That we can reasonably hope to supply from our works fuel for boiler firing, metal working, and other purposes demanding heat in great quantity, I do not believe. Such a gaseous fuel as will satisfactorily meet this demand may be economically generated upon the premises where it is to be consumed, and will contain in its total bulk more of the original energy of the coal than will a gas having sufficient heating power per cubic foot to be cheap to distribute and safe to use. Generated as wanted, it will carry to the point of combustion the sensible heat with which it left the producer—a further advantage over a generally distributed gas. It not being necessary to store this gas, distribute it over large areas, or supply it cold in small quantities, the presence of a considerable percentage of nitrogen is not fatal to its use, as in the case of the gas we are discussing. If I have not erred in this estimate of the field of fuel supply we can cover, the gas adapted to the wants of housekeepers, users of power, and generally of consumers of fuel in comparatively small quantities, is the gas we must produce. What is this gas?

Among manufactured gases which are not made wholly or in large part of oil, resin, or other material very rich in hydrocarbons, coal gas is the ideal fuel for most purposes. With a high heating power per cubic foot, unmistakable odour, and "tough" flame, it certainly answers the conditions of a successful fuel, unless we have to except cheapness of production. Does it answer this condition also? It is said that in some favoured localities coal gas is being put into the holder at a cost that would enable the makers to sell it to fuel users at a price lower per unit of energy than that at which a mixture of coal and other gases could be supplied, if its use were made general. Coal gas in the holder at a low figure argues one or both of two conditions—low cost of soft coal, high price of coke. The cheapest gas will be made where both conditions exist; and this can only be where there is a demand for smokeless fuel, and a high selling price for anthracite. Were coal gas generally adopted as fuel in such a locality, the amount of coke put on the market would be increased at least fivefold, and at the same

* See JOURNAL, Vol. LII., p. 25.

time a considerable part of the demand for it would be met by gas. With its field in part taken taken from it, and its own quantity largely increased, the price of coke must fall until it reaches a point at which it can compete with soft coal for the purposes to which the latter is adapted. The amount thrown upon the market will force it from the position of a special fuel, commanding a higher price because it better meets the wants of certain consumers than does soft coal. I believe that, with their present make of coke, few gas-works do not at times accumulate a large stock. Multiply the make by five or ten, and can we doubt that the selling price must be very materially reduced to enable its owners to dispose of it? And if we take from the manufacturing accounts of the companies producing this cheap gas the credit due to this most important residual, can coal gas then be generated at a figure justifying its sale at a price to compete with the cheap coals from which it is made? A careful consideration of the question, will. I think, convince us that we cannot afford, in generating our gas, to manufacture a bye-product to compete with it in the fuel market. I admit that there may be cities in which the demand for furnace coke for manufacturing would equal the supply after the general introduction of gas had increased the coke output. In such localities, if any exist, coke might advantageously be made in ovens, and the bye-product —gas—purified and stored for distribution at a low cost. The few exceptions to the general rule do not, I think, affect the force of my argument.

As it is bad business policy to produce two commodities which shall compete with each other for a market, and as soft coal is the raw material suitable for conversion into gas, most plentifully and widely distributed over the world, we seem compelled to adopt, except in special localities, a method of manufacture that will convert this solid coal into a gaseous fuel, without the production of another substance applicable to the same purposes. I look for no contradiction from any source when I say that, unless there is in another course some object to be gained in the direction of more complete conservation of the energy of the raw material, or lower cost of production, which shall compensate for the attendant disadvantages, it is desirable that our product shall contain all the gas that may be distilled from the coal and resulting tar, with as much combustible gas as can be made from the coke, and nothing else. Such a mixture, if of coal and water gases only, would have a heating power per cubic foot somewhat less than two-thirds that of coal gas (about 400 units), a specific gravity of about ·500, and its total heating power would equal somewhat over 60 per cent. of the original energy of the coal. In proportion as producer gas is made a constituent of the mixture, the heating power per cubic foot, and "toughness" and temperature of flame will diminish; and the specific gravity, size of the necessary holders, mains, and meters, and the percentage of the energy of the coal in the total product, will rise. Thus, as we convert more of the coke from the distillation of the coal to producer gas, we correspondingly diminish the value of our product for each purpose to which it is applied, and increase the difficulties of distribution and utilization. The return we get for this impoverishment of our gas, and possible annoyance to our consumers, is an increase in the total energy derived from the coal. It is not safe to distribute a gas containing as much as 30 per cent. of producer gas, because of the danger of light draughts extinguishing its flame. The additional energy we could put into the total bulk of the product of a ton of coal by this admixture is less than 5 per cent. To save this, it would be necessary to increase very materially the bulk of the gas, and therefore the size of the storing and distributing apparatus.

In the paper that is above referred to, I estimate the product of 2000 lbs. of soft coal made into coal and water gas as 89,000 cubic feet, representing 54·5 per cent. of the energy of the coal; and converted into coal, water, and producer gases (a third of the coke going to the last) at 66,000 cubic feet, containing 57 per cent. of the energy of the coal. Here the gain through the generation of part producer gas is but 2·5 per cent. Later investigation leads me to the belief that my analyses of producer gas did not do it justice, and that the gain in energy resulting from its introduction to the product will be nearer 5 per cent. The increase in bulk is nearly 70 per cent.; and the flame temperature is reduced upwards of 400°. In that paper I said: "It is principally upon this increase of bulk and reduction of flame temperature that I base my objection to the admixture of producer gas. We must provide storeage room for a portion, and a very considerable portion, of our product. The amount, whatever relation it bears to our daily output, will necessarily be increased in proportion to the amount of gas required to supply a given demand for heat. To supply this demand will require of the mixture containing producer gas 60 per cent. more than of that containing only coal and water gases, and render necessary 60 per cent. more holder capacity. There is, of course, a pressure at which it will be found most advantageous to deliver this gas; and at that pressure the carrying capacity of our mains must be 60 per cent. greater for the more bulky mixture to deliver the same amount of heating power. This estimate makes no allowance for the difference in specific gravity, which would make the comparison still less favourable to the producer gas mixture." Since this was written, the practicability of continuously distilling coal in retorts, with a portion of the waste heat from the generation of water gas —a problem I was then working upon—has been satisfactorily demonstrated, with a resulting economy in manufacture and increase in production of commercial gas per ton of coal. This will explain why I now believe we can obtain better results than I then claimed as possible. Further thought upon the utilization, or rather prevention of tar, convinces me that it can be made to have a more considerable and beneficial effect upon the product than I then allowed for. This mixture of the three gases would contain upwards of 30 per cent. of nitrogen, and have a heating power about 60 per cent. that of the combined coal and water gas, or 40 per cent. that of coal gas. It needs no argument to prove it a less valuable fuel, per unit of energy contained, than the stronger compound; and I do not deem it necessary to reason further in defence of the claim that the richer in heating power per unit of bulk a fuel gas is, consistent with economy of production, the better our prospect of customers and profit. The considerations I have presented to you have led me to the conclusion that a mixture of coal and water gases in the proportions in which we can produce them from bituminous coal, meets the conditions of a successful undertaking better than any other possible combination, and have compelled me, in my efforts after a successful apparatus, to hold as a *sine quâ non* the conservation of practically all the products of distillation, and the exclusion of nitrogen.

If I am correct in my conclusions anent the composition of a practicable fuel gas, I may now ask, and endeavour to answer the question: "What are the conditions that a perfect process must fulfil in its production." In the first place, a portion of the combustible constituents of the coal must be burned to supply the heat absorbed in the generation of the gas; the remainder should be present in the product. Secondly, the coal thus consumed should leave the apparatus as carbonic acid and steam. Then the sensible heat of the escaping gases should be utilized to pre-heat air or steam, and be so carried back into the apparatus. The radiation from the apparatus should be at a minimum. That part of the gaseous product of the coal having the highest heating power per unit of bulk should be present in the commercial gas. The raw coal should be subjected to the highest possible temperature, from the moment it enters the apparatus until the last distillable portion of the hydrocarbon gases and vapours has been driven from it. Finally, the tar made should be converted into gas, as far as possible before condensation; and as a means to this end the water gas, hot from the producer, should be passed over the coal being distilled. To my mind these conditions can only be fulfilled in an apparatus providing for the distillation of the coal in a vessel isolating it from the gases generated in the combustion necessary to the supplying of the heat of gasification. Whether or not this vessel be of the form we are accustomed to call a retort—whether horizontal, vertical, or inclined, receiving coal by the shovelful or by the ton—for the conservation of the coal gas made in it, its contents must be kept from contact with any gas not intended to become part of the commercial product. I am aware that insistence upon this point precludes the use of any simple cupola process for the manufacture of fuel gas for distribution.

To fulfil the conditions which I have considered necessary to a perfect process, it is essential that the coal-containing vessel should be heated by the combustion around it of a practically continuous stream of the otherwise waste heat of the process. I am aware that insistence upon this point precludes the use of an independent fire for the coal distillation. It is further necessary that the coal gas as made should be at once removed from the apparatus, and not brought in contact with any incandescent material other than the sides of the containing vessel. I am aware that insistence upon this point precludes the adoption of a plan involving the passage of the gas through masses of hot coke for its so-called "fixing." It is necessary to the generation of a product having the greatest heating power per cubic foot consistent with the conversion into gas of all the combustible constituents of the coal, that the waste or blast gases resulting from the combustion of that part of the coal supplying the heat of gasification should be as poor in carbonic oxide as a proper regard for the conditions essential to the generation of a good quality of water gas (principally depth of fire) will permit, and contain almost no hydrogen. I am aware that insistence upon this point precludes the generation of a producer gas suitable to meet the fuel demands of manufacturers, as a step in the process of fuel gas making. In this connection, I will at once admit that, in a locality where a considerable amount of producer gas can be utilized so near the generator as to reach the point of consumption hot, and there is an opportunity, very limited in proportion, for the sale of fuel gas, it would perhaps pay to run one apparatus for the satisfaction of both demands. The admission of steam to the generator during the period of "blowing" preparatory to making water gas, and the consequent reduction in the quantity of the latter in proportion to the enrichment of the blast gases, makes in this process the distributable fuel gas little more than a bye-product of the generation of producer gas. But if the sale of the fuel we are considering is destined to reach in its proportions the expectations of most men who have given thought to the matter, it is to my mind folly to consider any plan which has not for its object the conversion into a distributable gas of the greatest possible proportion of the energy of the coal. In a properly arranged and proportioned plant, there will be work enough for the products of combustion from that part of the coal which must be burned to supply the energy necessary to the conversion of the rest of it into gas.

Owing to our inability to make water gas or distil coal except at a high temperature, the carbonic acid resulting from the combustion referred to will leave the apparatus carrying much heat, and may be accompanied by a small proportion of carbonic oxide. The heat sensible in each, and resulting from the combustion of the latter, may be used to pre-heat the air necessary to the operation

of the apparatus, and the steam used in generating water gas. Where mineral oil is cheap, the excess of heat in the blast gases can be utilized to distil a proportion of it, with the desirable result of an increased heating power per cubic foot of the product, and the further advantage of giving to the gas a serviceable illuminating power. Localities possessing both soft coal and mineral oil, each cheap, are favoured beyond all others, as viewed by a fuel gas enthusiast. He could there hope to make an ideal gas cheap enough for use as a fuel, and so rich in hydrocarbons as to produce a satisfactory light, at low cost, without the aid of special appliances. Where there is no opportunity for the application of the waste heat to the distillation of oil, there is work for the greater part of it in connection with air and steam, as indicated above.

If 45 lbs. of coke are sufficient for the generation of 1000 cubic feet of water gas in an apparatus built to fulfil, as far as the imperfections of workmanship and a proper regard for capital account will permit, the conditions I have given as, to my mind, essential to a perfect process, 2000 lbs. of soft coal should yield, according to its quality, from 40,000 to 45,000 cubic feet of gas, having a heating power of from 375 to 400 units per cubic foot, and representing 60 to 65 per cent. of the total energy of the coal. As arrangements for pre-heating the air used in the process were perfected, or other improvements reduced the consumption of coke per 1000 cubic feet of water gas made, the product would be increased in total bulk and energy. This would result in a slight reduction in the heating power per cubic foot, because the water gas has a heating power below that of the commercial mixture.

Whatever process is adopted in the manufacture of fuel gas from soft coal, having for its aim the conversion of all the combustible material to gas, either waste or commercial, a portion of the coal must be burned to supply the heat necessary to produce the change of form. I admit that this can be accomplished with less loss of heat through radiation in a simple generator process than in an apparatus which the attainment of the end I aim at would demand. But in such simple cupola process there is of necessity a mixture of blasting with coal gas, involving a loss to the final product of the best part of the material, or a mixing with it of nitrogen and carbonic acid, or both. This fact is not affected by any ingenious application of exhausters, or the use of up, down, or alternating draughts. Such a process, comprehending this loss, is under the obligation to show, as an offset to these palpable defects, some compensating economies, or confess its own weakness. The disadvantages of an admixture of nitrogen are so serious that, between the horns of the dilemma, the operator of this process must choose to sacrifice some of the gases resulting from the distillation of coal. This means serious loss, not only in the waste of gas, but in the consequent reduction of the heating power per cubic foot of the product.

There are many reasons why it is advantageous to the users of gaseous fuel to have it delivered to them at pressures considerably in excess of those usually prevailing in the gas-mains. It is not, perhaps, necessary to enumerate these. One only I will mention —viz., the increased duty of lamps in which the illumination results from the incandescence of material woven into the form of a "mantle" or "cage." The increase in efficiency extends to both lamp and gas, and is the result of localizing the combustion by increasing the intimacy of the mixture of air and gas before reaching the burner-tip. The "mantle" or "cage" under these circumstances is more highly heated, and therefore more brilliantly incandescent, with a correspondingly increased duty; and the gas being more completely burned while within it, less of the resulting heat is wasted, and the efficiency per cubic foot is increased. The improved result is effected without any increase in the amount of gas used, or shortening of the life of the lamp. The total area of the gas inlets is reduced for the increased pressure, and there is practically no more wear on the incandescent material. I mention this instance of the desirability of comparatively high delivering pressure because of my belief that lighting by incandescence is to be one of the potent causes of the success of fuel gas. That a most satisfactory result may be obtained with a non-luminous gas has been established. With the mixture of coal and water gases I have been considering, I believe we have in incandescent illumination a competitor of the electric light which has the advantage of it in colour and price, and is less liable to the objection of heat than the open flames we now generally use.

The disadvantages of the use of high pressure are perfectly well known, and I believe are easily overcome. The increased tendency to leakage must be met by greater care in the laying and maintaining of conduits. The danger from breaks can be obviated by the use of automatic valves. Such pressure as it would be necessary to carry to satisfactorily supply all consumers, and enable them to operate at the maximum efficiency such appliances as they would be apt to use in burning the gas for heat or light, would not imperil the integrity of the pipes or joints. Not more than 10 inches water pressure, or less than ½ lb. per square inch, would answer all purposes. I have put miles of mains and services under an air and water pressure of more than 100 lbs. without any effect beyond the discovery of rusted-out services and defective joints. I do not think anyone will question our ability to so lay cast-iron bell and spigot pipe that the leakage will not be excessive with 10 inches pressure. The advantages of high pressure are the greater range permitted the consumer in the utilization of the gas, and the larger carrying capacity of the mains. A pipe will deliver twice the amount of gas at 10 inches as at 2½ inches of pressure. The fact that any leaks existing would be more readily detected and stopped is an offset to the disadvantage of greater liability to leakage. Meters made by first-class manufacturers can be trusted to properly measure at 10 inches pressure.

In the paper already referred to, I gave the efficiency of gas cookers and heaters as varying from 32 to 77 per cent.; quoting Mr. T. Travers [*vide* paper read in 1880 before The Gas Institute] as my authority. A long series of experiments made last winter by Mr. Carter H. Page, jun., for the Company who employ me, gives a lower efficiency for cookers. The work was done with stoves from eleven makers, all about the same size, and each consuming between 30 and 40 cubic feet of gas per hour. The efficiency of the various burners was from 14 to 52 per cent., and the maximum (in which we are most interested, as indicating the best result so far attained) was 55·4 per cent. The average of all burners of the eleven stoves was about 22 per cent., and of all burners of the best stove under specially favourable conditions about 38 per cent. It is only fair to the gas to state that no efforts were made in this series of tests to provide for the recovery of waste heat. The stoves were just as the makers put them on the market. I am pleased, in view of the above figures, to be able to say that there is much room for improvement in gas-stove construction. In comparing the efficiency of fuels, it is only fair to consider the work done with the best appliances obtainable. With the best stove at his command, Mr. Page obtained an efficiency of 38 per cent. in an experimental test. Afterwards, in cooking meals for five persons, he found the efficiency reduced to 29·8 per cent. With a good coal range he obtained an efficiency of 3·36 per cent.—starting, as with the gas-stove, all cold, and cooking three meals a day. In each case care was exercised to prevent waste. In these tests the gas had the advantage of intermittent use, which it would lose in the case of heating-stoves or furnaces kept alight night and day. In such work the advantage of gaseous fuel, though still very considerable, would be much reduced.

Mr. Young's Paper.

The discovery and application of natural gas for domestic heating and for manufacturing purposes in a number of places, and its superiority over coal as a fuel, has stimulated research into the possibility of manufacturing a fuel gas to supply localities not favoured with the natural article. Some of our ablest and most advanced gas engineers have taken the matter in hand, and have, in these meetings and elsewhere, expressed their faith in the ultimate commercial success of a manufactured fuel gas. That there are at present, however, very great difficulties in the way, will, I think, be admitted by the most sanguine. The most formidable difficulty that has to be encountered is what I may term the commercial difficulty—viz., that of producing the gas at a price at which people will buy it. There are other difficulties which our experience in the supply of natural gas has made very evident to us, and it is probable they may have been overlooked to some extent by those having no experience in supplying fuel gas. I refer particularly to the erratic and varying demand and to the great disproportion between the maximum and minimum demand. These may be termed simply mechanical difficulties; but to overcome them will greatly increase the commercial difficulty, as it involves excessive outlay on plant. In order to make this matter as clear to you as possible, I shall deal with the whole of our domestic consumption in Allegheny City.

Allegheny City is supposed to contain a population of from 90,000 to 100,000. The number of houses is probably about 15,000, of which we supply 7500. We consider we supply almost every house worth serving; and probably, in the cities of the size and character of Pittsburg and Allegheny, not more than half the houses would use fuel gas, even if its cost approached the price of coal. There are various reasons for this, which your experience in supplying illuminating gas would suggest. Taking, then, the city of Allegheny, with its 100,000 population, as an illustration of the quantity of fuel gas required for a given population, we can learn, from our experience with natural gas, something of the capacity of a fuel-gas plant required for its supply. We can arrive at this pretty correctly from the fact that about one-half of our consumers are supplied by meter. There is, therefore, no hap-hazard estimate as to the quantity of gas required. Last winter was exceptionally mild, and the figures would give the minimum rather than the maximum of winter consumption. The average consumption per house per day from Nov. 1 to April 1 was 2000 cubic feet; but as at least 75 per cent. of this quantity is used between the hours of 7 a.m. and 10 p.m., it would be necessary to provide for an average consumption of 100 cubic feet per hour for each house, or at the rate of 750,000 cubic feet per hour, making for the 15 hours a total of 11,250,000 cubic feet. Add to this the additional 500 cubic feet required for each house for the balance of the 24 hours, and we get a total of 18,000,000 cubic feet as the quantity necessary to supply 7500 consumers on an average winter day. You will notice, however, that for 9 hours out of the 24 the consumption is only 500 cubic feet per hour for each house, equal to a total of 416,666 cubic feet per hour, as against 750,000 feet for the other 15 hours; the average for the 24 hours being 625,000 cubic feet per hour.

I need not point out to you that, to produce gas economically, it is necessary that the production should be pretty nearly uniform during the 24 hours. To make 750,000 cubic feet of gas per hour for 15 hours, and then drop to 416,666 cubic feet for the remaining 9 hours would be very awkward and also very costly. It will, therefore, be necessary, in order to get uniform production, to

have a storeage capacity of 3,750,000 cubic feet. There is, however, another and more difficult phase of the matter. In arranging for the supply of fuel gas to any community, it will be necessary to provide manufacturing and distributing plant adequate to meet the greatest consumption. This will, of course, occur on the coldest days. As the temperature rises or falls, so in a regular proportion will the quantity of gas consumed be greater or less. With a given consumption at a temperature of 32° Fahr., it will increase from 50 to 60 per cent. if the temperature falls to zero. In the changeable climate of America, such a fall often occurs in the course of 24 hours. Within that period the consumption may rise from 750,000 cubic feet to 1,125,000 cubic feet per hour; requiring 16,875,000 cubic feet instead of 11,250,000 cubic feet in the 15 hours—an increase of 5,625,000 feet in 15 hours. You can appreciate the difficulty of being suddenly called upon to increase your production by upwards of 5½ millions. Therefore, to avoid intermittent work, and to provide against failure, it will be necessary, in order to supply even the comparatively small number of 7500 consumers, to have an enormous storeage capacity. In the demand for illuminating gas, there is a gradual and steady increase from the minimum to the maximum consumption; and a corresponding steady decrease from the maximum to the minimum. On the contrary, during seven months in the year the demand for fuel gas is most erratic—sometimes varying from 50 to 60 per cent. in 24 hours; and seldom will the demand be anything like uniform for a week together. In June, July, August, and September, the consumption of fuel gas dwindles down to a mere fraction of the winter consumption.

The difficulties that have to be met in erecting a fuel-gas plant are: (1) The necessity of providing a manufacturing and distributing plant equal to the greatest demand (which demand may only exist for two or three weeks in the year), involving great outlay and comparatively small returns; and (2) providing for an erratic demand, necessitating great storeage capacity, or else intermittent and expensive working. It may not be uninteresting if I try to give an idea of the capacity and cost of a fuel-gas plant necessary to supply 7500 consumers. I shall assume the possibility of distilling the volatile matter from a bituminous coal, and converting the residual coke into water gas at one operation in the same vessel. I shall further assume that the process will produce 30,000 cubic feet of the mixed gases per ton of coal, giving 400 heat-units per cubic foot. I shall also assume—and it is a considerable assumption—that, by improved appliances for using the gas, one cubic foot of the fuel gas containing 400 heat-units per foot can be made to perform the same amount of work that one foot of natural gas is now doing with its 1000 heat-units per foot. I shall estimate that coal will cost $2 per ton; and that each stoker (I do not know any better term) will produce 75,000 feet per day. To get at the maximum quantity required, it will be necessary to get the average temperature for the five months on which our figures are based, and then allow for the extra quantity required at a zero temperature. The average temperature for the five months was 36·64°; and, as the average daily consumption of gas was 15,000,000 cubic feet, we must add at least 50 per cent. to this quantity—making 22,500,000 cubic feet the maximum daily quantity that must be provided for. The yearly capacity of a plant providing 22,500,000 cubic feet of gas per day is 8,212,500,000 cubic feet; but as during (we shall say) seven months of the year the average daily consumption is only 15,000,000 cubic feet, and during the other five months only one-fifth of this quantity, the total required for the year is only 3,639,000,000 feet—equal to only 44 per cent. of the actual producing capacity of the plant. I am not sufficiently conversant with the cost of fuel-gas plants to give a very correct estimate of the cost of a plant capable of producing and distributing 22,500,000 cubic feet per day; but if I place it at $3,000,000, I think I shall rather under than over estimate it. With these data, I shall try and show at what figure fuel gas can be produced:

	Dols.	Per 1000 Cubic Feet.
121,300 tons of coal, at $2 per ton.	242,600	or 6·660 c.
48,520 days, one man, $2	97,040	„ 2·660 c.
Management and office expenses	20,000	„ 0·549 c.
Distribution, repairs, and maintenance (streets) . .	26,000	„ 0·714 c.
Wear and tear and yard expenses	36,390	„ 1·000 c.
8 per cent. on $3,000,000	240,000	„ 6·595 c.
		18·178 c.

You will observe that there is nothing included for purification or leakage. The gas produced from the volatile portion of the coal should contain about the usual percentage of ammonia. If this is extracted, manufactured, and sold, I assume it would pay for the purification. I have taken the cost of coal at $2 per ton, as I presume that is about an average price, Of course, any advance of, or decrease in that price will proportionately affect the cost of the gas. If the above figures are anything near correct, they indicate that a fuel gas containing 400 heat-units per cubic foot can be produced and sold at 20 c. per 1000 cubic feet, when the quantity produced is large. The problem to be solved is: Can this gas be made to perform the work of heating and cooking in a house at a cost not to exceed 25 per cent. more than the cost of coal? I believe it must do this in order to become a popular fuel. One ton of coal will develop 27 million heat-units. By perfect combustion, and greater utilization of the developed heat, it may be possible to make 30,000 cubic feet of gas perform the work of a ton of coal; but even then the quantity of gas will equal coal at $6 per ton.

You will bear in mind that the estimate I have made of the quantity of gas to be produced is based on the supposition that 1000 cubic feet of fuel gas of 400 heat-units per foot will perform the same amount of work we are now doing with natural gas having 1000 heat-units per cubic foot. Our experience with natural gas so far does not give us much encouragement in this direction; but our appliances are still crude, and our consumers are wasteful and extravagant. One is very apt to form an opinion of what can be from what is; and were I called upon to give my opinion, judging from the results we have obtained from natural gas, I should have to say that fuel gas cannot be made a commercial success. I refer, of course, to a practical every-day fuel that will do all the work of a house. An ornamental fuel, that may be used for only a few hours in the parlour when company is present, or for doing a little cooking during the summer months, or for taking the chill off the atmosphere in a bed-room or bath-room, is a different thing. So far as that kind of fuel is concerned, the problem is already solved. In regard to the other, if the public demand a fuel gas, there is hardly a doubt that the demand will be met, no matter how difficult the problem may be. It may, and probably will involve an entire revolution in our methods of heating our houses and in the appliances for that purpose; and I think it is in this direction that the success of fuel gas has to be looked for. The motto of to-day is "Excelsior" in everything that relates to health and comfort. At no time in the world's history has the importance of pure air been realized as it is to-day. In our cities, the filthy, unhealthy, costly, and unscientific system of throwing thousands of tons of unconsumed carbon, in the form of smoke, into the atmosphere, to depress our spirits, irritate our lungs, dirty our collars, sap the vital energies of our wives and daughters by the incessant warfare against dirt, and lower the whole tone of our moral and physical natures, must be abolished. Gaseous fuel is the solution of the problem. It may be difficult, it may be somewhat costly; but there is nothing impossible, unless it involves omnipotent power for its accomplishment.

The Crystallization of Iron.—At the second ordinary meeting of the Liverpool Engineering Society for the present session, the members were occupied with the discussion of a paper, entitled "Some Causes of the Crystallization of Iron," read in April last by Mr. T. Morris, F.G.S., of Warrington. Mr. Morris, whose long experience in iron manufacture entitles his opinions to be received with respect, contends that the well-known brittleness frequently developed in iron is the result of compression, and not of vibration, as generally stated. He further contends that this explanation meets the case of crystallization, whether developed by hammering, vibration, frost, or any other cause. Mr. Morris's views were vigorously combated.

Protecting the Pavements in New York City.—It is reported that the Park Board of New York have adopted a resolution under which all gas and electric companies, sewer builders, and the like, applying for permission to take up the streets for any purpose, will be compelled to deposit a sum of money equal to the original cost of the pavement, to be held until the roadway is restored to good condition. "This," says the *Engineering and Building Record*, "is precisely what we have been urging for years; and the soundness of the principle, and the necessity for action, cannot be questioned. All other city authorities should promptly follow the example, which, however, does not go far enough, since the work of restoration should be done by the city's own *employés* and under the direction of its engineers, the cost to be paid out of the deposit, which should be more than the original cost of the pavement. It is easier to get good work that way than to wrangle with the contractor of the parties who rip up the streets."

Electric Light and the Eyesight.—M. Lubinsky has lately communicated to the congress of Russian Physicians, the results of researches carried out by him on the influence of the electric light upon the eyes. During the last ten years, he has observed 30 cases of ocular casualties amongst young sailors employed in close proximity to electric machines. The symptoms of the disease (which it is proposed to term "photo-electric ophthalmia") are very characteristic, and appear only during sleep. The disease is manifested by an abundant flowing of tears, accompanied by intense periorbitary pains. The photophobia attains a special intensity. Upon an ophthalmoscopic examination, signs of hyperhemia of the pupil of the eye, and in some instances a venous pulse in the cavities of the retina, are found. After a period varying from an hour and a half to two hours, these tumultuous phenomena become less painful; the invalid regains his interrupted sleep, and rises well the next morning—feeling at the utmost but a slight ocular fatigue, as if he had been reading too late the previous night. Sleep is an indispensable condition for the appearance of the "photo-electric ophthalmia." So long as the affected person is in a state of wakefulness, he will only experience a slight burning sensation; and he might even read and write during the evening which precedes these nocturnal ocular disorders. These afflictions are essentially attributable to hyperhemia of the optic nerve, and some injury to the nerve fibres. The foregoing will demonstrate the injurious effect of the electric light upon those who are exposed to its influence to a slight degree; but the evil results must necessarily be much intensified in the case of persons who are for twelve hours or more, subjected to its incessant glare. Consequently, for use in schools, colleges, libraries, and concert-rooms, it will have to give place to gas, consumed in high-power burners.

MODERN GAS-ENGINE PRACTICE.

At the Meeting of the Society of Engineers on Monday last week, Mr. S. GRIFFIN read a paper on the above subject. The author first described the general construction and principle of the Lenoir engine—taking this as a fair type of non-compressing gas-engines; and having alluded to its high gas consumption and general defects, he proceeded to investigate its chief theoretical requirements, tabulating them in their natural order. He then pointed out how very imperfectly these were met. Having illustrated the defects of this engine by means of an indicator diagram, Mr. Griffin described and illustrated the Otto and Langen atmospheric engine; remarking that this motor followed the Lenoir distinctly in the order of time as well as that of improvement. He described its working cycle, and pointed out that, although differing so greatly in outward appearance as well as in methed from the Lenoir, their cycles, and consequently their theoretical requirements, were practically identical. The reasons of its great economy as compared with the Lenoir engine were then discussed, and shown to arise from a better adaptation to theoretical requirements; the charge being introduced without throttling, there being no change of volume after the cut-off previous to ignition, prompt maximum pressure, and rapid and full expansion of the working charge. The indicator diagram used in illustration of these points further revealed the fact that cooling of the charge during the contraction of its volume increased its efficiency.

From the consideration of the Otto and Langen engine the author passed to that of the modern compressing gas-engine; pointing out that some 25 years since the advantages of compression, together with the double-cycle engine, were fully described by Beau de Rochas—this same cycle, in combination with compression, being afterwards employed by Dr. Otto. He then proceeded to describe the general construction and cycle of the "Otto" engine; taking it as a fair type of the modern compressing gas-engine. Its great economic success was shown to be almost entirely due to the use of compression, coupled with sound mechanical arrangement. The theoretical and practical value of compression having been described and illustrated by means of an indicator diagram, the author quoted the two principal objections which have been urged against the "Otto," or two-cycle engine, by practical engineers—viz., first, its cyclical variation and insufficient development of power; secondly, the insufficient expansion of its working charge.

The author then described several engines which have been introduced with a view to improvement on the points above mentioned. The "Clerk" engine was cited as the first to successfully obtain an impulse at each revolution of the crank with compression of the charge; the practical gain being, however, counterbalanced by increased complication and negative work. The author's double-acting engine was next described, and the practical advantages claimed for it were discussed; the behaviour of the working charge in the cylinder being illustrated by an indicator diagram, taken from a 12-horse power nominal double-acting engine. The second objection to the ordinary double-cycle engine—viz., the insufficient expansion of its working charge—was then noticed; and the efforts made by Mr. Dugald Clerk, Messrs. Crossley Bros., Mr. Atkinson, the author, and others, towards improvement in this direction, were briefly alluded to. The author described his experimental engine for obtaining increased expansion; illustrating his remarks by a sectional elevation of the cylinder, together with three indicator diagrams taken with three different grades of expansion. Mr. Atkinson's cycle engine was next alluded to; the behaviour of the working charge being also illustrated by means of an indicator diagram. The practical results of increased expansion were considered—the author pointing out that, at best, the gain arising from it was very small, and not such as would warrant the introduction of any complication to obtain it; there being the further disadvantage of greatly increased bulk for a given output of power.

Having briefly alluded to a number of important points which could not be dealt with, by reason of the limited time at his command, the author concluded by indicating a few of the directions in which development of the gas-engine might be expected to extend; giving it as his opinion that future gas-engines will be constructed upon the lines of those of the present day—improvement being in the direction of detail rather than principle.

A FRENCH EXPERIMENT IN THE GRATUITOUS INSTALLATION OF GAS.

At the Meeting of the Société Technique du Gaz en France held at Boulogne last year, M. Melon read an interesting paper, in which he expounded his views as to the best means of developing the consumption of gas, and described the measures adopted by him with the object of achieving this desirable result in Lille, where he has the supervision of the gas-works. In the abstract of the papers read at that meeting which subsequently appeared in the JOURNAL, M. Melon's communication was summarized; and it may be remembered that among his proposals was the gratuitous supply of gas-fittings, provided an intended consumer would undertake to burn only the Company's gas for a certain number of years, with a minimum annual consumption per burner. This system had then lately been adopted in Lille; and consequently on meeting his colleagues in Paris last summer, M. Melon was able to give them the results of the year's working. These have been already briefly recorded in our columns; but it may be of interest to give a few additional particulars.

On April 30 last the number of installations fitted up gratuitously in Lille by the two Gas Companies supplying the town and its suburbs was 443, comprising 1525 lights. The greatest number were for three burners—279; those for two burners numbering 119. Two installations of 25, and four of 35 burners each had been furnished at that date. These 443 installations represented an annual guaranteed consumption of 228,750 cubic metres, or rather more than 8 million cubic feet of gas. The minimum consumption per burner per annum required by the Companies to be guaranteed was 15 cubic metres—roughly, 5000 cubic feet; and when the proposition was submitted to the members of the Société Technique, many of them expressed the opinion that the figure was too high. M. Melon explained that it had been fixed after a very careful investigation as to the average quantity of gas passed in the course of a year by two and three light meters. He admitted that, in other towns, the fear entertained by his colleagues in this respect might have some justification; but in the industrial region of the north of France—the district he had to deal with—it appeared to him that it would soon be exceeded. The figures for the first twelve months showed that his anticipations were well founded. The accounts of 94 consumers, representing 242 burners, gratuitously fitted, had to be made up for the year. The consumption, according to the undertaking given, should have been 42,400 cubic metres; in reality it was 46,164 cubic metres, or an average consumption of 190 cubic metres per burner, being 40 cubic meters more than the minimum fixed. Some few of the small consumers (principally those having installations of two and three lights) did not come up to the limit; but the explanation given of this was that the number of burners they asked for was really in excess of their actual requirements. At any rate, the result presented by M. Melon showed that, taking the average, the 150 cubic metres per burner per annum had been largely surpassed. This fact furnished a complete answer to an objection which had been brought forward, that the class of consumers who would be brought on to the books by the new system would be less productive than the ordinary customers. Indeed, M. Melon was of opinion that they were the most profitable of the Companies' clients, inasmuch as they consumed per burner the largest quantity of gas. A further objection had been raised to the system, on the ground that the new class of consumers would be just those who would be likely to involve the Companies in considerable losses. In answer to this objection, M. Melon stated that out of the 443 consumers who had availed themselves of the system, only four were lost—two, who had six burners, having failed; and two, with a similar number, who had run away. This was a loss of less than 1 per cent.—certainly not a very high figure. But M. Melon pointed out that the fittings remain in the possession of the Company supplying them for three years, before the expiration of which time an agreement would no doubt have been concluded with the new occupier of the premises.

The results achieved during the short period in which the system has been in operation in Lille have encouraged M. Melon to increased activity in extending it. He is convinced that it will be more widely adopted in the future. With regard to the attendant benefits, he cites the case of Antwerp, where the introduction of the system has resulted in the recovery of the greater number of those consumers who, owing to the low price of petroleum, had been led to discontinue the use of gas. In that city, the increase in the consumption of gas last year, as compared with 1887, amounted to 30 per cent.—a result which M. Melon thought would be appreciated on its merits.

SOCIETY OF ARTS.—The 136th session of this Society will open on the 20th inst. with an address by the Duke of Abercorn, C.B., the Chairman of the Council. Among the subjects to be considered at the Wednesday evening meetings before Christmas will be that of "London Sewage," which will be dealt with in a paper by Sir R. Rawlinson, K.C.B. The Christmas lectures to children will be delivered by Professor Vivian B. Lewes, who will tell them the "Story of a Flame." The Secretary (Mr. H. Trueman Wood, M.A.), who has returned from Paris full of honours for his able management of the business of the British Section of the Exhibition, will read a paper on the subject of that stupendous show on the 11th prox.

THE DANGERS OF ELECTRIC LIGHTING.—According to a list compiled by Mr. Harold P. Brown, of New York, 87 persons had met with their death through electric light installations up to the commencement of the present year. This, as *Engineering* remarks, is a very serious total; and if there were any likelihood of the rate being maintained, it would supply ample reason for very stringent legislative control being exercised over all electric installations. Mr. Brown is opposed to the alternate current system; and as this system is rapidly spreading over London, and also in many parts of the kingdom, this is a question which interests Englishmen directly. Are we running special risks by permitting its establishment? As far as lighting currents of 50 or 100 volts are concerned, it certainly matters little or nothing whether they are direct or alternate, for neither will produce any serious injury on the human frame. But when it comes to currents of distribution of 2000 volts, it is quite conceivable that death is more certain by the alternate current. Unfortunately, it is also fairly certain with the direct current; so that there is very little to choose between them. A house in which the fittings were charged to such a potential would be as dangerous as a battlefield.

Register of Patents.

MANUFACTURING HEATING OR FUEL GAS.—Loomis, B., of Hartford, Conn., U.S.A. No. 15,983; Nov. 5, 1888. [8d.]

This invention, says the patentee, relates to the manufacture of a high-grade fuel or heating gas, at comparatively small cost—particularly adapted for manufacturing purposes, such as firing steam-boilers, heating glass-furnaces, pottery kilns, forges, metallurgic and other furnaces, stoves, &c.*

One of the principal objects of the present invention is to provide for economically manufacturing water gas by the use of bituminous or soft coal or slack; and the patentee claims to have successfuliy accomplished this object, partly by reason of the down-draft used in heating the coal to incandescence preparatory to decomposing steam, and partly by reason of passing the hot water gas out of the bed of fuel at a considerable distance below its surface, and then out of the furnace. In this way the injurious melting and caking of the fresh layers of coal at the top are prevented, and the oily and tarry vapours evolved from this fresh coal are caused to pass downward into the hot fuel below, where they are converted into fixed rich hydrocarbon gas, which mixes with the water gas as it passes into a circular flue and out of the furnace. When the highly-heated water gas is passed up entirely through the bed of soft coal or slack, it often causes much trouble by melting the fresh coal, and causing it to run into cakes or crusts; but by this method of passing the hot gas off below the top of the fuel bed, these difficulties are overcome. Another object is to evenly distribute the fuel around the side walls of the furnace, and prevent the formation of channels and the passage of air, steam, and gases through such channels along the walls. This is accomplished by drawing the air and gases away from the side walls, by constructing a solid hearth or floor next to the walls at the bottom of the fuel chamber, and forming a contracted grate-opening at or about the central portion of such hearth. Still another object is to provide for the better combustion and gasification of soft coal or slack by means of a down-draft and exhauster.

It will be understood, the inventor here remarks, that the water gas is generated intermittently; one period being used for heating the fuel by the air-draft, during which time a large volume of valuable producer gas is given off, while the next period is used for decomposing steam in contact with the incandescent coal for the production of water-gas composed of hydrogen, carbonic oxide, and carburetted hydrogen. It is thus seen that the water gas is partly carburetted or enriched with carburetted hydrogen distilled from the coal, and is therefore a more valuable heating gas than water gas made in the ordinary way. The steam employed for the production of the water gas, whether obtained from the gas cooler or otherwise, is led through the flue which leads the producer gas from the furnace to the gas cooler, which is in direct connection with the exhauster. This flue is provided with heat-absorbing division walls, for the purpose of superheating the steam before it passes from the flue to the ash-pit of the gas generator, and thence into the incandescent fuel. Before this part of the process is started, however, the exhauster is thrown out of action; and the pipe which conducts from the exhauster to the gasholder, is sealed by admitting steam to a closed water box, and thereby forcing up water into the gas-conducting pipe.

GAS MOTOR ENGINES.—Pinkney, C. W., of Smethwick. No. 19,013; Dec. 2, 1888. [8d.]

The object of this invention is "to provide an efficient gas-motor engine of certain and regular action, wherein (in normal working) there is an impulse at each forward stroke of the engine, and wherein the cylinder is purged from products of combustion before the next motive charge is admitted." The invention also includes arrangements for starting the engine and for governing it, and supplying gas thereto, and other details. The engine is of the class wherein the mixture of air and gas is compressed before ignition.

In the engine two cylinders are employed: one being the cylinder in which the motor piston works, and the other the cylinder by which the gas is forced into the first-named or motor cylinder. The front ends of both the motor and gas cylinders are used as air-pumps; the pistons thereof forcing air through passages or pipes into an air chamber or reservoir provided with an outlet passage leading to the end of the motor cylinder whereat the charge to be ignited is admitted. This chamber is provided with an inwardly opening valve, by which (on the back stroke of the engine) air is drawn into the chamber and thence into the motor and gas cylinders—for being, at the return strokes, pumped back under pressure into the air chamber. Then, when a certain pressure is obtained, the air passes into the combustion chamber of the motor cylinder. The pistons of both cylinders are made of considerable length; that of the motor cylinder acting as a valve to cover and uncover the exhaust port when the piston of the motor cylinder has travelled to near the end of its forward stroke. The pressure in the part of the cylinder into which the charge to be ignited is received (the combustion chamber), is then lower than that in the air chamber; and consequently the valve by which air is admitted from the air chamber to the combustion chamber opens, and air passes into the combustion chamber and sweeps out the products of combustion of the previous charge through the exhaust port. Whilst the gas-cylinder piston has been making its forward stroke at the same time as the motor-cylinder piston, the gas-pump piston has drawn in gas into the space at its rear, through a gas inlet-valve opening from a gas inlet-chamber to the gas cylinder—air passing into the combustion chamber at the same time. When the pistons make their back stroke, that of the motor cylinder compresses the air in the combustion chamber. As already explained, both pistons, at the time of making their back stroke, draw in air into the spaces at their forward ends. When the pistons have nearly completed their back stroke, the piston of the gas cylinder acts on a valve (which is at other times pressed to its seat by a spring) and so opens communication with the gas chamber to allow the remaining compressed gas to pass into it and back to the gas-pipe. The valve by which gas passes into the combustion chamber then closes, and the motor-cylinder piston completes the compression of the mixed air and gas in the combustion chamber. At about the end of the back stroke, a valve (normally held to its seat by a spring) is opened to allow a portion of the compressed mixture from the combustion chamber to flow into a hot tube or other form of igniter, so that ignition takes place (or an electric circuit is completed so as to give an igniting spark), and the motor-cylinder piston is driven forward. The gas-cylinder piston also makes its forward stroke, and both compress air and pass it into the air chamber.

For starting the engine, there is a relief valve fixed at a convenient position on the motor cylinder, which when opened allows some of the air that would otherwise be compressed in the combustion chamber to escape; and there is also a relief passage controlled by a plug valve in the gas cylinder and communicating with the gas chamber and supply-pipe, so that when the valve is opened, the gas leaks back to the supply pipe in a proportion which ensures only a proper amount of gas being supplied to the combustion chamber. When the engine is properly started, these air and gas relief-valves are kept closed by the pressure due to combustion.

For governing the engine, an ordinary centrifugal governor is used, which, when the engine exceeds the proper speed, acts on a lever that moves a tumbler on a counterweighted lever into such a position that a projection (which may be on the rod that actuates the valve to the igniter) comes into contact with the tumbler so that the counterweighted lever is operated, and through links or connections acts on levers or the like to bring them into a position to prevent the gas-supply valve to the gas cylinder and the air-supply valve to the combustion chamber closing. In this way the air and the gas, instead of meeting and mixing, are passed back again without mixing; and consequently no ignition takes place until the speed of the engine is reduced.

The arrangement already described for admitting the gas to the motor cylinder is applicable more especially where electrical ignition is adopted; but in cases where ordinary ignition is used, the patentee prefers to first pass the gas through a valve opening outwards from the gas cylinder into an ante-chamber (which may be on the cover of the cylinder); and to control the passage of the gas from this ante-chamber into the motor cylinder, there is provided a trip valve which is opened by trip gear at or about the time when in the back stroke the piston of the motor cylinder has covered the exhaust port, so that the gas then passes into the air in the motor cylinder in sprays or otherwise. This opening of the trip valve may be effected by means of a cam on the crank-shaft connected by a rod with a lever acting on the trip valve, which valve is loaded by a spring to keep the pressure required in the ante-chamber. The trip valve then closes; and the motor piston continues to compress the charge of gas and air in the combustion chamber; and when it is at about the end of the compressing stroke, the ignition-valve is opened, and allows the gaseous mixture to flow into the heated ignition tube or other igniter, which causes ignition and drives the piston forward. Where the ante-chamber and trip valve are employed, the sytem of levers acted upon by the governor may be extended so as not only to maintain the air and gas valves open but also to move out of position a part which, during the normal working of the engine, is acted upon by the device which opens the trip valve. Thus when the engine runs at too high a speed, the gas will not be passed into the motor cylinder, as the trip valve will remain closed until the parts return to their normal position.

GAS LAMPS AND BURNERS.—Flood, S., of Crediton. No. 5468; March 30, 1889. [6d.]

This invention (in the words of the patentee) consists of a "piece of plain mica, talc, or any other incombustible substance, circular in form, and perforated with holes of any shape, and placed in position to moderate and direct the draught of air for the combustion of the gas issuing from the nib or burner, when using either a gas moon, globe, opal, cup, saucer, or the like, to remedy the forked appearance or other irregularity of the gas-flame." It is said that the invention may be "performed" thus: "Take a piece of mica, talc, or other suitable material, and form the size required for the covering of the base of either the gas moon, globe, opal, cup, saucer, or the like, in a circular form; and in the centre make a hole large enough to allow the burner or nib to pass through to supply the nib with gas." [An example of what is allowed to pass the Examiners under the present Patent Laws!]

GAS-PRESSURE REGULATORS.—Lake, H. H.; communicated from P. Noyes, of Boston, Mass., U.S.A. No. 9769; June 13, 1889. [8d.]

This invention in gas-pressure regulators embraces improvements for automatically varying and increasing the pressure from a minimum to a maximum point, and *vice versa*.

Fig. 1 is a sectional view of a gas-pressure regulator; while fig. 2 shows a sectional view of the automatic pressure-changing attachment. Fig. 3 shows the automatic pressure-changing attachment applied to another form of regulator.

In figs. 1 and 2 the casing has an inlet B and an outlet C adapted to be coupled to a gas main or pipe. In the casing is a valve-seat D, and a moveable valve E to regulate the quantity of gas passing through the casing and the pressure of the same. The valve is connected by a rod with an inverted cup or holder H, which floats in a sealing liquid (such as glycerine) in an annular reservoir formed between the wall of a cylindrical chamber or cup and an inner cylindrical wall forming a part of an inner casing or cup N placed on the bottom of the outer casing. P represents a vertical tube affixed to the valve casing and passing through holes formed to closely fit its exterior, in the superposed bottoms of these outer and inner cups. On the tube is placed an elongated washer or binding tube, the lower end of which is pressed down upon the bottom of the inner cup by a nut screwed upon the upper end of the tube, or bearing directly on the bottom of it. The cups are thus securely held in place. The inner cup has an annular wall, which surrounds the tube P and washer, and is separated therefrom by an annular space which receives the sealing liquid from the outer annular reservoir through a tube or passage S connecting them. A smaller inverted cup T or holder, attached to the holder H above described, extends into this inner reservoir. The space within the inverted cup T communicates through the tube P with the valve casing at the receiving side of the casing; and the top of the cup is of the same area as the valve E, so

* The patentee's original invention, founded on patent No. 4469 of 1886, was described and illustrated in the JOURNAL for Aug. 6 last, pp. 251-2.

Fig. 1.

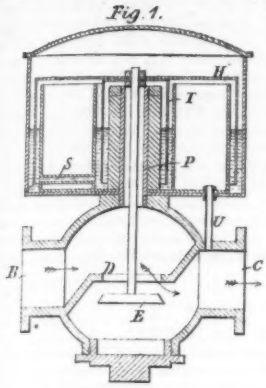


Fig. 2.

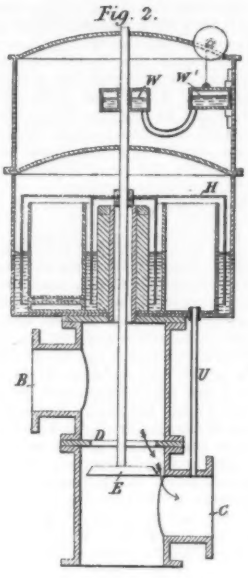
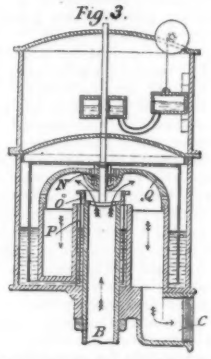


Fig. 3.



that the valve is balanced by the pressure against the cup T. The outlet portion of the casing is connected by a pipe U with the space between the outer and inner walls of the inner cup, so that gas enters this space and (according to the pressure) raises or lowers the holder H, and with it the valve E, causing the latter to move toward or from its seat, as the case may be.

The same construction is shown in fig. 2 excepting as to the valve casing, which is composed of sections secured together by flanges on their adjacent ends. The valve seat in this case is a ring interposed between the flanges. The automatic pressure-changing attachment here shown consists of two weight holders W W¹ to contain mercury, and a tube connecting the holders so that mercury can pass from one to the other. The holder W is attached to the valve stem; the latter being extended upwards as shown. The other holder W¹ is engaged with a vertical rib or guide on the inner surface of the casing which contains the attachment, and is vertically moveable on the rib or guide by means of a shaft or windlass on which is a chain or rope supporting the moveable holder W¹. When the holder W is lowered with the valve so that its bottom is lower than the bottom of the holder W¹, mercury flows from the latter into the holder W, and increases the load on it and the valve. By raising or lowering the holder W¹, the increase in the load by a given change in the vertical position of the holder is decreased or increased as the case may be. The windlass is provided with a dial marked so that a fixed pointer on the casing will indicate the position of the holder W¹ for a given result.

In fig. 3 the automatic pressure-changing attachment is shown in connection with a pressure-regulator of well-known construction, in which the gas enters a dome under the floating holder and passes thence to the outlet C. The dome is between the gas inlet pipe B and the floating holder H, and has holes through which gas enters the holder. The dome has a spheroidal valve-seat N, against which the valve O closes; the valve being of annular form and provided at its outer edge with a downwardly projecting tube P, which enters the liquid in the inner sealing reservoir. On the dome is an annular holder Q for glycerine or other sealing liquid; and into this holder projects a tube which is attached to the floating holder. This tube by entering the sealing liquid in the cup Q prevents any leakage of gas around the valve-rod when the latter passes through the top of the casing.

Gas Usable as an Explosive and in Admixture with other Gases as an Illuminating and Heating Gas.—Tatham, E., of Balmain, near Sydney, New South Wales. No. 13,763; Aug. 31, 1889. [4d.]

The object of this invention is the production of a gas or gaseous mixture the principal uses of which are as a motive power in gas and explosive engines, as a destructive force for blasting and like purposes, and (in admixture with hydrogenous gases—such as coal gas, water gas, &c.) for producing gases of very high illuminating and heating powers.

The gas usable as an explosive consists of oxygen charged with hydrogen and carbon; but if intended to be employed as an illuminating and heating gas it consists of the mixture of oxygen, hydrogen, and carbon passed into and admixed with ordinary coal gas, water gas, or the like.

The patentee proposes to take commercially pure oxygen (whether partially ozonized or not is immaterial) in a reservoir or holder preferably under pressure, and pass it through liquid hydrocarbon—say crude oil, gasoline, benzine, kerosene, naphtha, or such like—in a mixing vessel in which it dissociates the hydrogen and carbon, and from which the whole commingle and are drawn off as "improved gas." To manufacture an illuminating or heating gas, a certain quantity of the explosive gas is passed from the mixer into a holder containing the hydrogenous gas. Any reasonable proportion will suffice within a range from one part by bulk of the explosive gas to one hundred parts of hydrogenous gas, to one part explosive to nearly (but not quite) two parts hydrogenous gas. But the best proportion for illuminating gas is seven parts explosive to one hundred parts hydrogenous gas; and for heating gas (say) from fifteen to twenty parts explosive to one hundred parts hydrogenous gas. The resultant of the former mixture is said to be a gas of very high illuminating power, while the latter mixture produces a gas of great heating power.

APPLICATIONS FOR LETTERS PATENT.

17,008.—Haedicke, H., "A combined gas and steam motor engine." Oct. 28.

17,039.—Dick, W. B., "Improvements in or relating to gas and oil stoves." Oct. 29.

17,050.—Barlow-Massicks, H., and Crooke, W., "An improved gas-valve, particularly applicable for hot blast stoves or furnaces." Oct. 29.

17,140.—Fritz, A. A., "Apparatus for producing an inflammable gas by carburation of air." Oct. 29.

17,162.—Orme, D., "Improvements in gas-meters for supplying a predetermined or prepaid quantity of gas." Oct. 30.

17,171.—Hutchinson, R., "Improved gas-regulator for heating or lighting purposes." Oct. 30.

17,190.—Gibson, J., "Utilizing the power in water supply pipes or mains." Oct. 30.

17,286.—Peck, H, J., "Improvements in gas-lamps. A communication from H. G. Downton. Oct. 31.

17,295.—Niel, P., and Janiot, A., "Improvements in gas-motors." Oct. 31.

17,296.—Brown, H., "A gas-regulator." Oct. 31.

17,400.—Crist, W. E., "Improvements in gas-engines and igniters for the same." Nov. 2.

Fresh Issue of Capital by the Slough Gas Company.—At the meeting of the shareholders of the Slough Gas Company on Monday last week, the Directors were empowered to increase the capital of the Company by £3000; so that they may call up a sufficient sum to pay for the proposed erection of a Board-room and Manager's house, and also call up what amounts may be found necessary from time to time for the enlargement of, and for additions to the works and mains. For the half year ending June 30 last, there was a balance of profit of £807.

A Bankrupt Secretary.—At the London Bankruptcy Court, last Wednesday, Robert Watson, described as of the Ship Hotel, Dover, gentleman, applied to Mr. Registrar Linklater, for his order of discharge. The debtor stated that his business had been chiefly that of Secretary of public companies; among others (for 20 years) the Hornsey Gas Company. His liabilities were stated at £504 10s., no assets; and he attributed his failure chiefly to losses on railway shares, and discounting bills for persons who afterwards became insolvent. Upon the case being called, a short adjournment was asked for on behalf of creditors; it being stated that certain offences would be alleged against the bankrupt, but that time would be required to complete the necessary evidence. His Honour thought this was very reasonable; and adjourned for a fortnight the hearing of the application.

The Price of Gas at Mexborough.—The deputation that was appointed at a recent meeting of the Mexborough Local Board to wait upon the Directors of the Gas Company, with the object of obtaining a reduction in the price charged for gas, reported, at a meeting of the Board last Wednesday, the result of their interview (*ante*, p. 705). They said they were courteously received; and the Secretary subsequently forwarded a letter to them, stating that the price of the gas supplied to the large street-lamps would in future be 3s. 4d. per 1000 cubic feet, instead of 3s. 6d. as heretofore. The Chairman (Mr. Tiptaft), in answer to an inquiry, said he thought the reduction would apply to all the gas the Board consumed.

The Stoke-on-Trent Corporation and Electric Lighting.—Last Thursday a special meeting of the Stoke-on-Trent Town Council was held to consider the question of electric lighting. Notices had been received from two companies of their intention to apply to the Board of Trade for authority to supply the electric light within the borough; and in moving that the consent of the Corporation should not be given to the proposed Provisional Orders, Alderman Leason said that the town possessed gas-works for which the rates were liable to the extent of £67,000. It therefore behoved the Council to resist the efforts of outsiders to come into the borough for the purpose of depreciating the value of their property. The time was not far distant when the Council would have to invest further capital either in extending their gas undertaking or providing the means of supplying the electric light. He therefore thought it would be advisable for the Corporation themselves to apply for an Order empowering them to supply electricity; and this, while keeping away outsiders, would give them an opportunity of considering whether they should extend the gas-works or light the congested parts of the town by electricity. The motion was seconded by Alderman Kirkham, and carried unanimously. The Council subsequently agreed to make application for a Licence or Provisional Order, to give them power to lay down the necessary plant and to supply electricity.

The Baildon Local Board and their Water Supply.—A meeting of the Baildon Local Board was held last Tuesday evening, when the question of acquiring water from Hawksworth Moor for the use of the township was considered. The Board had before them the three following schemes:—With the object of meeting the rights of parties who have water from Herncliffe Beck, it was suggested that a compensation reservoir be constructed, of 7½ million gallons capacity, for a limited area of the watershed. This, with the cost of pipes to join the Board's conduit at Birch Close and the procuring of an Act of Parliament, was estimated to cost £7250. The second scheme was the construction of a compensation reservoir to contain 11½ million gallons, compensating for the whole of the gathering area, including Knapley Hill, at a cost of £9250, this sum to cover all necessary expense. The third scheme was the construction of a compensation reservoir of 10 million gallons capacity for gathering water on the west side of Knapley Hill, to cost £8100. Mr. Walker, the Board's Surveyor, attended, and stated that he had consulted Mr. G. H. Hill, of Manchester, as to the matter in question, and he and Mr. Hill had agreed that the second scheme was the more preferable. He also laid before the Board a report from Mr. Hill to this effect. The Board, after discussion, adopted the scheme, and decided to construct a compensation reservoir of 11½ million gallons capacity. It was also agreed to call a meeting of ratepayers with a view of obtaining their consent to the Board's intention of applying to Parliament during the ensuing session for the necessary sanction to carry out the work.

Correspondence.

[We are not responsible for the opinions expressed by Correspondents.]

A SCHEME FOR SHARING PROFITS WITH WORKMEN.

SIR,—I send you a scheme adopted unanimously by the Board of this Company, at their meeting on Wednesday last, for giving their workmen a direct interest in the profits of the Company, on the principle of the sliding scale. From the inception of the sliding scale, I have always felt that its operation ought to extend beyond the shareholders, to those whose labour assists to make the Company prosperous; but hitherto the way has not been clear. Now, however, all obstacles have been removed. The scheme has been put to the men; and I am glad to say has already been adopted by between 600 and 700 of them.

South Metropolitan Gas Company, Nov. 11, 1889. GEORGE LIVESEY.

NOTICE TO WORKMEN.

In order to give to every regular workman employed by the Company a direct interest in its prosperity, the Directors are prepared to place to the credit of every such workman who will sign the form of agreement herewith annexed, a sum of money annually, as a bonus or percentage on his wages, regulated by the price charged for gas, on the principle of the sliding scale, so that the workmen as well as the shareholders shall be benefited by reduction of price.

The shareholders get ¼ per cent. additional dividend for each reduction of 1d. per 1000 cubic feet. The workmen's scale will be 1 per cent. on their year's wages for every 1d. reduction below 2s. 8d. per 1000 cubic feet, which at the present time will amount to 5 per cent. on the wages of the present year.

For the purpose of making a good start, and in order that the men may derive a substantial benefit at once, the system of bonuses shall be calculated three years back; that is, for the first year it will be 2, for the second 3, and for the third 3 per cent., which is equal to 8 per cent. on one year. This will give to the man who has been in regular employ for three years, at (say) 30s. per week, rather over £6; to the 24s. a week man, about £5; and other rates in proportion. Four per cent. interest will be allowed on each man's account, who will have the option of receiving it yearly, or of letting it accumulate at compound interest. When a man has attained a certain age, or has been a certain time in the service, he will be entitled to the whole sum, principal and interest. No money, except in the case of death, is to be withdrawn during the first year; nor during the first five years, except in cases of death, superannuation, or leaving the service of the Company.

Those men who accept this offer are requested to give in their names to the Engineer of their station. As soon as possible, a Committee—to be composed of equal numbers of workmen selected by themselves and officers chosen by the Directors, presided over by the Chairman of the Company—is to be formed to settle all details.

This offer is made as a recognition of faithful service in the past, and as an inducement to the same in the future. The money will be the absolute property of the men, except in the case of a strike or wilful injury to the Company; in which cases, and in those only, it will be forfeited by those men guilty of that conduct.

By order of the Board,

Nov. 6, 1889. (Signed) GEORGE LIVESEY, Chairman.

NOTE.—At the expiration of five years, any man may withdraw one-half of the money standing in his name on giving three months' notice, or the whole on giving six months' notice; or he may leave the whole or part at interest.

MEMORANDUM OF AN AGREEMENT made the day of 1889 between for and on behalf of the South Metropolitan Gas Company, of No. 709A, Old Kent Road, in the county of Surrey, of the one part, and of the other part.

1. The said for the South Metropolitan Gas Company agrees to employ the said if he shall remain sober, honest, industrious, and able to do the work allotted to him, for a period of twelve months from the day of the date hereof, at one or other of the stations of the said Company.

2. The said agrees to serve the said Company for the period of twelve months, in whatever capacity he may from time to time be employed by the said Company, at the current rate of wages applying to such capacity.

3. The said agrees to obey the orders of the foreman in charge.

4. The work in the retort-house is to be carried on on the eight-hour shift system; each gang working one shift in the 24 hours.

5. The hours of working for yard-men to be 54 hours per week.

6. The Company undertakes that no alteration shall be made in the wages to the disadvantage of any of the men.

7. The said to be entitled to the benefit and be bound by the conditions of the annexed notice.

As witness the hands of the parties,

No obstacle will be thrown in the way of any man engaged under the above contract who may wish to leave the Company's employment before the expiration of the period of service therein agreed for, provided he shall notify such wish to the Engineer of the station at which he may for the time being be employed; and on receipt of such notice, the Engineer shall, in his discretion, consider whether the services of such man can be dispensed with without detriment to the Company, and, if so, permission will be given at the expiration of such notice as the Engineer may deem sufficient.

GAS AS AN AUXILIARY TO COKE FOR HEATING PURPOSES.

SIR,—The statements of Dr. Pole, published in your issue for the 5th inst., are, I may venture to state, not the results which are obtained in average practice. With regard to the Siemens gas and coke fire, the enormous evolution of carbonic oxide, and the very inferior results obtained at the Manchester Smoke Abatement Exhibition, are surely sufficient to settle this fire permanently on its own merits. Dr. Pole states that "it is difficult to keep coke burning in an ordinary grate." On the contrary, anyone who burns coke in an ordinary grate with fire-brick back and sides, knows very well that it burns steadily and even fiercely, without assistance. The use of coal with coke has the great advantage of not only making a bright flaming fire, but almost (if not entirely) does away with the serious objection to coke alone—its tendency to throw red-hot bits into the room. My own experience with the Siemens fire is that, in a properly constructed grate, the fire is better in every respect without the use of gas, irrespective of the one serious fault which Dr. Pole quite ignores—the fire makes as much dust and clinker as an ordinary coke or coal fire, and requires to be cleaned out completely every day. If the tests of the Siemens fire had not been omitted from the report of the Manchester Smoke Abatement Exhibition, this very unsatisfactory arrangement would years ago have been kindly forgotten, as the blunder of a great man. I am informed that it was omitted purposely from the report, simply out of consideration for the name and reputation of its inventor.

Warrington, Nov. 9, 1889. THOS. FLETCHER.

THE VENTILATION OF SEWERS.

SIR,—The article on the above subject which appeared in the JOURNAL for the 29th ult. (p. 842) is evidence that the matter is of interest to your readers; and as the ventilation of mines by heated columns of air, and also by mechanical means, has occupied my attention for nearly 40 years, perhaps my views on the question may be of assistance.

The use of public gas-lamps for sewer ventilation, whether the idea is new or old, does not seem to me likely to be successful in the manner in which the project has been submitted—whether by Mr. Bridge, Mr. J. Penn, or Dr. Tomkins. Because, even if it served to draw off the gases when the lamps are lighted, and so create ventilation, what would be the use of the system in the height of summer when the lamps are not lighted, and just when the odours emanating from the sewers are most disagreeable? As a means of ventilation, the proposal seems quite insufficient. It may draw off gases to a very trifling extent in the main sewers; but what about the small service drains to each house, where all the mischief lurks? Such a plan would do little good there. If, however, a heated column is intended to be applied, as a means of suction, then surely the flame should not be, as it would, at the top. To have any value at all, each lamp-post should serve as a chimney, and a small flame of gas be kept burning day and night at the surface level. This would have a little "pull" at the sewer. Still, with the lamp-posts 60, and often 80 yards apart, it does not seem to me likely to suffice.

Before I leave Dr. Tomkins, I will just note that he considers there should not be any gases from decomposition; and to his mind the proper remedy is "efficient flushing and ventilation." Quite so. The flushing is simple enough; but how about the ventilation? That is not so clear. Let us try to ventilate the subject a little. If the gas-lamps will not do—and no doubt those of your readers who are specially interested in gas will hail my idea of gas-fires burning day and night as a "happy thought"—what can we try next?

Mr. Wallis, M. Inst. C.E., says he has the right thing; and, from his description, it seems likely that he has patented it. But he is going to let the town of Eastbourne experiment with *his* "happy thought" free of cost. Let us hope they will try it. It seems possible that the question is more difficult than many people suppose. No doubt the main sewers may, by sufficient mechanical power, be ventilated pretty easily; but it is the small pipe-drains which require consideration.

Not being a sanitary engineer, I will only assume a case. Let us take a town of 50,000 inhabitants, equal to 10,000 houses. Given a position which is at the highest level of the drainage system, and so located that it is within two miles of every house in the town, what volume of air per unit of time will suffice to clear all the drains, great and small, and what vacuum will be necessary at the exhauster or fan to reach and empty the small drains two miles distant? That is your problem, Mr. Wallis. What do you say to it?

Let us consider that for each house there are a certain number of cubic feet of drains; say—

		C. Ft.
Main sewer,	20 lineal feet by 20 feet area	= 400
Branch sewer,	20 „ by 9 feet „	= 180
House drains,	40 „ by 2 feet „	= 80
	Total drain space	= 660

Then 10,000 houses multiplied by 660 cubic feet equals 6,660,000 cubic feet for a town of 50,000 inhabitants. (I should be glad to know how this assumption agrees with any known facts.) Now, how often should this air be renewed? Suppose we say once in every twelve hours; then —6,660,000 cubic feet divided by (12 × 60) 720 equals 9222—say, 10,000 cubic feet per minute. This, as a matter of quantity, is a mere trifle; but what as to vacuum? What will be required to draw the air through small pipes two miles distant? We have formulæ, based upon the friction of air in pipes; but they are not very reliable. It does not seem likely that 2 inches of water-gauge will be enough; and yet anything exceeding this will draw the water out of all the house closets in the place. Therein seems to lie the difficulty. If an inch would suffice, then a gas-engine of 4 indicated horse-power should do the work nicely. But now we have to consider another difficulty. All sewer gratings, both large and small, must be closed and sealed with a depth of water in excess of the vacuum; otherwise the air in the immediate neighbourhood of the fan would rush in, and the more distant drains would lie dumb. Then having made all illicit entrances air-tight, regulator slides would be required to every length of sewer and drain, to admit just so much air as that particular branch required, and no more. These slides would be under the care of an official, whose time would be well occupied in watching the entire arrangement.

This plan I leave in your readers' hands for free criticism.

Durham, Nov. 4, 1889. A. L. STEVENSON.

THE WINDSOR TOWN COUNCIL AND ELECTRIC LIGHTING.—The Windsor Corporation have given their consent to the applications for Provisional Orders of the Windsor and Eton Electric Light Company, Limited, and the South of England House-to-House Electricity Company, Limited. The former propose to charge per quarter for any quantity of electricity up to 84 units, £3 10s., and 8d. for each unit above 84; and the latter up to 20 units per quarter, 13s. 4d., and over 20, 8d. per unit.

Miscellaneous News.

BOMBAY GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Wednesday, at the London Offices, 6, Drapers' Gardens, Throgmorton Avenue—Mr. R. Davidson in the chair.

The Secretary (Mr. J. H. Perrins) read the notice convening the meeting; and the Directors' report and the accounts for the half year (which were summarized in the Journal for the 29th ult., p. 837) were taken as read.

The Chairman said that the meeting was an interim one; and he did not think he need detain the shareholders for any length of time. During the half year under notice, the quantity of gas sold amounted to 44,142,800 cubic feet, as compared with 43,084,700 cubic feet in the corresponding period of last year; showing an increase of 1,058,000 feet. It would be seen by the accounts that the revenue from gas and meter rental produced in round figures £24,786, as against £23,969, which gave an increase of £817. Coke, tar, fittings, and sundries had yielded an increased return of £1084. Putting these increases together, the result showed that last half year's receipts exceeded those for the June half of 1888 by £1901, as stated in the report. On the debitor side of the account the coal carbonized had cost £8515, as against £7517, which increase was accounted for by an additional consumption of 92 tons, and by the rise in price of coal and freights. The cost of coal per ton was £1 12s. 9d., as compared with £1 9s. 5d.—a difference of 3s. 4d. per ton. There was an advance in the item of wages of £262, which was due to extra labour employed in levelling and relaying mains, and to the conversion of the old purifier-house into a coal-shed. Trade charges also exhibited an increase of about £150, which was owing to the purchase of furniture for the new offices at Bombay and of sundry stores. Exchange remained without any material improvement; but it had been somewhat harder during the last few weeks, owing to purchases of silver by the English mint and also for the Continent. The Manager reported that the new purifiers were working most satisfactorily, and that the plant generally was in fairly good order. With these few remarks he begged to move—"That the Directors' report and the statement of accounts for the half year ended June 30 last, previously circulated among the shareholders, be now received and adopted."

Mr. W. B. M. Lysley seconded the motion, which was, without discussion, carried unanimously.

Mr. Robert King proposed a vote of thanks to the Chairman and Directors for the able manner in which they had conducted the affairs of the Company during the half year. Notwithstanding the heavy loss on exchange and the much higher price of coal, the Board, he remarked, had been enabled to pay the shareholders the usual dividend for the half year.

Mr. Blundell seconded the motion, which was cordially agreed to.

The Chairman briefly acknowledged the compliment; and the proceedings terminated.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Tuesday, at the London Offices, 30, Gracechurch Street, E.C.—Mr. Alfred Williams in the chair.

The Secretary (Mr. Alfred Lass, F.C.A.) read the notice convening the meeting; and the Directors' report and the accounts (some particulars from which were given in the Journal for the 29th ult., p. 840) were taken as read.

The Chairman moved—"That the report and accounts be received and adopted, and entered on the minutes." It was not necessary, he said, to make any observations with reference to the balance-sheet, but there was one matter in the report which should not be overlooked, and that was the loss the Company had sustained by the death of Mr. Arthur Clarke, who had been a Director since the commencement of the concern. The Board had forwarded a vote of condolence to the wife and family of their deceased friend; and it had been duly acknowledged. In the exercise of their duty, the Board had elected Mr. Charles Newton to the vacant position. He ought further to mention that Mr. Newton, having been elected a Director, had resigned the office of Auditor; and they would have to elect someone to fill his place at that meeting.

Mr. Charles Gandon seconded the motion, which was carried.

The Chairman next proposed the declaration of a dividend for the half year on the preference share capital at the rate of 8 per cent. per annum, and on the ordinary share capital at the rate of 7 per cent. per annum, both less income-tax (except upon the dividends of the local shareholders), payable on the 2nd prox.

Mr. Gandon seconded the proposition, which was agreed to.

Mr. E. K. Blyth said he had to propose a resolution appointing an Auditor in the place of Mr. Newton, consequent on the death of Mr. Clarke. He expressed deep sorrow at the loss of this gentleman, who, he said, had been an old and valued friend of his for many years. The resolution he proposed was to the effect that Mr Robert Berridge be elected an Auditor of the Company.

Mr. Robert King seconded the motion, which was passed unanimously.

The Chairman incidentally remarked that Mr. Berridge was Chairman of three different Gas Companies. Continuing, he said his next duty was a very pleasant one; and that was to move a vote of thanks to the Local Committee at Georgetown, the Secretary (Mr. Lass), the Local Secretary (Mr. F. A. Conyers), the Engineer and Manager (Mr. T. B. Younger), the Auditor (Mr. R. King), and the Solicitor (Mr. E. K. Blyth).

Mr. Newton seconded the motion, which was carried.

Mr. King responded on behalf of all mentioned in the resolution. He was sure, he said, that every one of them did his utmost to advance the interests of the Company. Mr. Lass kept the books in an efficient and plain manner; and their Engineer and the Local Committee appeared to be doing as well as was possible.

A vote of thanks was also accorded to the Chairman and Directors; and it was fitly acknowledged by the former.

An Improved Water Supply for Preston.—The Water Committee of the Preston Corporation have at present under consideration a report by the Surveyor on the desirability of laying another main from the water reservoirs into the town and the provision of some additional storeage accommodation.

The Public Lighting of Wimborne.—At the last meeting of the Wimborne Board of Guardians, it was announced that two tenders had been received for lighting the town—one from Mr. W. J. Bacon and the other from the Wimborne Gas Company. A member suggested that they should wait and see what the Electric Light Company intended doing in the matter; but the Guardians decided not to do so, and accepted the Gas Company's tender.

THE POSITION OF THE BRITISH WATER GAS SYNDICATE, LIMITED.

In the Journal last week reference was made to the circular recently issued by the Directors of the British Water Gas Syndicate, Limited, announcing their intention of calling up the remainder of the capital owing to circumstances set forth, and already dealt with by us. The position of the undertaking disclosed by the circular is not a satisfactory one from the shareholders' point of view; and one of them has addressed the following remarks thereon to a financial contemporary:—"In face of the circular of May 18 last, saying the Directors did not intend to call up further capital, the last circular has cast rather an ominous shadow around the whole affair. This is the opinion the market has taken, for the £3 paid shares, which have been £2¼ each, are now quoted at 1⅛ to 1¼. The reason is stated to be that the Nottingham and Derby Company has made an attempt 'to repudiate the specific performance of its contract.' If such be the case, the Nottingham Company has presumably some reason for thus acting, and, as is well known, nothing can justify a 'repudiation of a specific performance of a contract,' except a material misrepresentation of the merits of the patent, which, I suppose, will be the plea of the defendants in the case; and yet, in face of this, the original shareholders are asked to subscribe a further sum to a patent, the practicability and utility of which is impugned or denied, and at a time, too, when its trial is virtually *sub judice*. If the patent is really a practical and valuable one, and if all that was claimed for it in the prospectus was honestly true, surely the fairest way would have been for the vendors, who are the Directors, and for Mr. Samson Fox in particular (who was supposed to take a large block of shares, and who, at the first meeting of the Company, said: 'During the whole of the fall from 20 premium to 5 premium, he had been a purchaser, and that he had not sold a single share'), to have undertaken the costs of the litigation, and not to have asked present shareholders, most of whom, no doubt, are great losers at current prices, to find money to substantiate his patents. There is, at least, this hope left us—that if the Nottingham Company prove their position, we shareholders will not have much difficulty in inducing the Court to order a return of our money from the vendors." The writer concludes by saying that if such extreme measures have to be resorted to, he hopes a strong Committee of shareholders will be formed to deal with the matter. Another shareholder, writing to the same paper, considers that nothing could be more unfair to an inventor who has sold his patent to a company than to ask him to pay, out of his own pocket, the legal expenses of substantiating the validity of the patent, should it be afterwards called in question, when it was no part of the original agreement that he should do so. "Mr. Samson Fox," he says, "has shown his good faith and his confidence in the utility of the invention and in the ultimate success of the Syndicate by purchasing, at a heavy premium, and by continuing to hold a large number of shares in the Syndicate; and I submit that it is neither fair nor reasonable to expect him to do more. At the present time, I believe, no man stands to lose so heavily as Mr. Samson Fox, should the patents prove invalid; and yet, as a Director, he has had no hesitation in making calls, which, as a large shareholder, he must pay out of his own pocket."

The difficulty with the Nottingham and Derby Company came before Mr. Justice Stirling last Friday, upon a motion for an injunction to restrain the Company from going into voluntary liquidation. The meeting of shareholders to sanction this step having been called for Thursday next, and there being no possibility of postponing it, his Lordship consented to hear the motion on the previous morning.

AUSTRALASIAN GAS ASSOCIATION, LIMITED.

The First Annual General Meeting of this Association was held last Thursday, at Suffolk House, Laurence Pountney Hill, E.C.—Mr. H. L. Hammack, J.P., D.L., in the chair.

The Secretary (Mr. G. J. Gray) having read the notice convening the meeting, the report was presented. It stated that there was a profit on the first year's working sufficient to enable the Directors to recommend a dividend at the rate of 7 per cent. per annum for the second half of the year ending June 30 last; an interim dividend at the rate of 6 per cent. per annum having been paid in April last for the first half year. Six new gas-works have been acquired by the Association—viz., Benalla, Maldon, Seymour, Shepparton, Wangaratta, and Warragal—all in Victoria, and within an area which ensures efficient management from Melbourne; and a substantial interest has been secured in the Charters Towers Gas Company, Limited, of Queensland. In addition to these, new works are being erected by the Association at Sandgate, a promising township in Queensland; and they are expected to be completed by the winter. The report alluded to the decision of the Directors to raise additional capital for carrying on the work of the Association, as already notified in the Journal. Accompanying the report was the statement of accounts, certified by Messrs. Alfred Lass and Co., the Auditors to the Association.

The Chairman said he wished to make a few remarks upon the report and accounts. The latter, however, were so very clear and lucid, having been certified by Mr. Lass, that it became a very easy matter indeed. At the time of their statutory meeting, they were then only looking forward; but they had been since employed in accomplishing what they had in view. Then they had four works in prospect, which they had now acquired, after consultation with the Australian Committee, and a report from Mr. R. Thompson, who was the Engineer of the important and successful Metropolitan Gas Company of Melbourne. In addition, they had also acquired two new works at Maldon and Seymour, and they were erecting other works at Sandgate, in Queensland—about six miles from the capital. Referring to the accounts, he said the Board had allotted £38,000 worth of shares, of which they had called up £23,500. They had purchased six freehold gas-works at a cost of £35,000. The freehold interest in one works had not yet been acquired; but they were now negotiating for it. With regard to the revenue account, they had received £3537 for gas; and £160 had been realized by way of dividend on shares in the Charters Towers Gas Company. This Company was a successful one; and they had bought the shares which they held in it so well that they received nearly 11 per cent. on the investment. The receipts, therefore, amounted to £3697. The manufacturing expenses came to £1832, and only £530 had been expended under the head of management in England and Australia; so that for £2362 outlay, they had a profit of £1335. This gave them, after the payment of £168 interest on loans, and £356 for the interim dividend a net balance of £811, out of which the Directors proposed to pay the shareholders a dividend which would absorb £700, and leave a balance of £111. He might mention that the Company owed £12,648. They had owing—for gas, £797; coals in stock, £147; other stock, £117—making together £1061. They had £2076 in England and in transit to Australia; and uncalled capital amounting to £13,374. Therefore, to meet their liability of £12,648, they had £17,637, or a balance of more than £5000 in favour of the Company. Since June 30, the Directors had sent out £6250 to complete further purchases. The Chairman proceeded to mention that the Directors required additional capital; and he urged the shareholders to assist them in procuring it. The expenses both in London and Australia were only

nominal; and the Directors and officials were content to look forward to the future, rather than to the present, for the remuneration he hoped they would deserve. The fresh capital which they intended to raise was needed for new works; and when they became possessed of these, the management expenses would not be materially increased. A gas company which paid a dividend of 7 per cent. ought to readily find a great many people to invest in it. The Directors offered debentures at 4½ per cent. But they could only have debenture stock equal to one-half of the capital called up and expended; and therefore they had an absolute security. To those who preferred to take shares, he would say that he believed the Company would very soon be able to declare a higher dividend than 7 per cent. He noticed the other day that shares at Dartford, paying a maximum dividend of 7 per cent., sold at £40 premium; and therefore, when shares receiving 7 per cent. were offered at par, they were certainly worth recommending. At Melbourne the Gas Company were making 18 per cent. The Engineer who earned that (Mr. Thompson) was the Advising Engineer to their own Company; and they could not, he thought, be in better hands. He also spoke of the Company's indebtedness to the Australian Committee (the Hon. Thomas Bent, and Messrs. John Coates and E. Noyes); and afterwards stated that some of the works had only been in their hands for a few months, so that the accounts did not give the results of a full year's working with them. He concluded by moving the adoption of the report and accounts.

Mr. S. SPENCER seconded the motion, which was unanimously carried.

On the motion of Mr. G. H. HAYWOOD, seconded by Mr. HAIGH, the Chairman, who retired from his seat at the Board, was re-elected, as was also Mr. Haywood, who likewise retired, on the motion of the CHAIRMAN, seconded by Mr. LASS.

Mr. HAIGH moved that Messrs. Alfred Lass and Co. be re-appointed Auditors for the ensuing year.

Mr. MILLER seconded the motion, which was unanimously agreed to.

The interest which the Australian Committee and the staff had shown in the welfare of the undertaking was duly acknowledged by the shareholders, on the motion of the CHAIRMAN, seconded by Mr. SODEN; and on the proposal of Mr. HAIGH, seconded by Mr. MORGAN, the Chairman and Directors were also thanked for their exertions on behalf of the Company.

The proceedings then terminated.

SOUTH AFRICAN GAS COMPANY, LIMITED.

The General Meeting of this Company was held at the Guildhall Tavern, E.C., on Friday, the 1st inst.—Mr. W. MASTERMAN, D.C.L., in the chair.

The SECRETARY (Mr. Alfred Lass, F.C.A.) having read the notice convening the meeting, the report of the Directors, with the accounts from Oct. 22, 1887, to Sept. 30, 1889, was taken as read.

The CHAIRMAN, in moving the adoption of the report, stated that the Directors had postponed calling the meeting as they had hoped to be in the position to announce that the works were started. The delay had arisen from the fact that the Gas Appliances Company had been unable, he did not know why, to carry out their contract for the works. He was pleased, however, to be able to tell the shareholders that Messrs. Renshaw, King, and Co. had agreed to take it over and carry it out. The contract was therefore duly transferred to them, and the works were nearly finished. Naturally this had caused a great deal of trouble and delay. They were now only in the position of being able to furnish gas, instead of being in the much more forward state, which, but for the circumstances he had alluded to, they would have been in. They were, as he had said, in a position to make gas. But they could not do it without coal; and the next question, and the principal difficulty of the Directors, was how they were to raise the amount of further capital requisite for the immediate needs of the works. They had been inquiring with regard to the fittings, lamps, and materials which it would be necessary to send out to Cape Town; and he found it would involve an immediate outlay of £1200 to provide for the first public lighting, as required by the contract. He believed they would be able to supply a large number of private consumers. Woodstock was rapidly increasing in population; and there were very important districts in the vicinity. They had already laid in Woodstock about six miles of mains. He trusted the result of the meeting would be that steps would be taken whereby it would be possible for the Directors to raise the capital that would have to be spent in order to commence profitable working. He then proceeded to deal with the various items in the balance-sheet, and to explain his personal position in the Company. [It was stated in the report, which was issued on the 11th ult., that Mr. G. W. Stevenson had been compelled, through ill-health, to retire from the Board; and that the vacancy had been filled by the election of Mr. Masterman.] He next went on to say he believed there had been some trouble with the workmen at the Cape, which also had caused delay. But he was happy to report that the difficulties were now at an end. The main question to be considered that day was how they were to raise more money. It was a question demanding an immediate answer; and the Directors had looked at the matter very carefully, and had decided upon a further issue of debentures, at £90. This he admitted would be a great loss—10 per cent.—but it was essential that the money should be found, so that they might without delay light Woodstock. He trusted that when they were once at work they would occupy a much better position as regarded any future issue of capital. He believed that they possessed a very valuable property if they only overcame its temporary difficulty. The debentures would be considered be a good investment to the shareholders; and he urged them to take them up.

Mr. F. WILLIAMS seconded the motion.

A SHAREHOLDER asked the Chairman if he possessed, as their late Chairman—Mr. G. W. Stevenson—did, any technical knowledge in regard to gas and gas making.

The CHAIRMAN said unfortunately he did not. He was a lawyer; but he trusted he brought some business ability to the Board.

Mr. BENSON, as a member of a firm who manufactured gas appliances, and supplied them nearly all over the world, said he was extremely dissatisfied with the position of affairs, and especially as regarded the failure of the Gas Appliances Company to abide by their contract—why, they had not been told; and the Chairman did not seem to think it worth while to find out.

A SHAREHOLDER asked if any of the Directors were shareholders in the Gas Appliances Company.

The CHAIRMAN said they were not. At the present time, this Company had nothing to do with the Gas Appliances Company.

After further discussion on the question of the African Board not having duly qualified themselves to hold the position of Directors.

The CHAIRMAN explained that those Directors found they could not afford the outlay involved; and they therefore became a Committee of Management.

Some further discussion followed, in which much complaint and dissatisfaction was expressed at the position of affairs; but eventually the motion was put, and carried.

The retiring Directors (Messrs. R. A. Fairclough and F. Williams) were then re-elected, and the Auditors (Messrs. Edwards, Jackson, Browning, and Husey) re-appointed; and the meeting, which was a long one, closed with a vote of thanks to the Chairman.

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held last Tuesday at their Offices, Marylebone Road—Sir W. H. WYATT presiding.

The SECRETARY (Mr. G. B. Hall) read the notice convening the meeting, and the Auditors' report, which stated that the investments of the reserve fund were as reported last year—viz., £7203 Metropolitan Consolidated 3 per cent. stock; £7250 New South Wales 3 per cent. inscribed stock; and £6800 Victorian 4 per cent. inscribed stock. The repair and renewal fund also remained the same—viz., £7534 Metropolitan Consolidated 3 per cent. stock. The Company had also £100,000 on deposit at interest with the London and Westminster, London Joint Stock, London and County, and Union Banks. The gross rental of the half year to Michaelmas last amounted to £112,365, showing an increase over that of the corresponding period of 1888 of £2839. The water rental received during the half year to Sept. 30 last was as follows: On account of rates to Lady-day, 1889, £50,250; on account of rates to Midsummer, 1889, £49,661; and on account of street watering, £36, making a total of £99,948. The balance to the credit of dividend and interest account was £138,771.

The CHAIRMAN said he was afraid he should not be able to say much of interest to the shareholders, for really in most respects they had had an uneventful time. The report he thought told them nearly everything he could tell them. In the first paragraph, they referred to the approaching completion of their new reservoir. That work was now finished and they proposed that day to inspect it. The reservoir had an area of 130 feet by 200 feet. It was 16 feet deep; and would hold 2½ million gallons. It would be of great advantage in supplying the large district that was growing up round Willesden. It was a beautiful work and had been most satisfactorily executed. He thought the cost will be well within the contract price; and that was a satisfactory feature. They stated in the report that they were having two of the old engines taken out at Hammersmith—the two oldest there; and they were replacing them with one Worthington engine of greater horse power than the two old ones combined. To show them the importance and economy of having the best engine power that they could obtain, he might tell them that the new engine which had been put up at Hampton saved them more than 800 tons of coal last year compared with what they would have used had they had the old engines there. The old engines, moreover, would scarcely have done the work which the new engine had. But apart from that, they had saved 800 tons of coal, which was a large saving in one year. That, too, was a feature of special importance in connection with the question of strikes, when one hardly knew from day to day how he was going to get the coal he required. In view of this subject, it became the duty of everyone employing steam power to see whether he could, by having improved machinery of the best and most economical kind, be less dependent on human beings. That brought them to another paragraph in the report, in which they state that they experienced some anxiety during the recent strike. Their trouble was with the lightermen. There was no hitch in connection with the contracts for the coal; but the difficulty was in getting it lightered up the river. To make sure, they had some coals by road; but that, of course, cost more money. At the same time, they felt that no matter what the cost was, they must have the coal, and so willingly paid the extra amount. They were now paying at least 4s. a ton more than last year for their coal; and this, on a consumption of nearly 300 tons a week, made a serious difference in the amount of the working expenses. They must, however, try and save it in every possible way they could. At the same time, the former prices of coal were exceptionally low; and perhaps they had no right to expect that they would always continue so. But still, it was a heavy advance compared with former prices. The works were in excellent condition; everything they had got being in a most satisfactory state. He thought those who had looked over the accounts would agree that they were also very satisfactory. They had incurred considerable expense in replacing the engines to which he had referred; and the cost had been charged to revenue. Nevertheless, they were able fairly to pay their 10 per cent. dividend, and to put something to the good. That, too, was after giving the consumers a discount of over £10,000—in fact, nearly £11,000—a year. He thought that was a most satisfactory condition for the Company to be in. He then moved the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. James Meyer) seconded the resolution, which was carried unanimously.

The CHAIRMAN next moved—"That a dividend on the consolidated stock of the Company, for the half year to the 30th of September last, at the rate of 10 per cent. per annum, less income-tax, be declared."

The DEPUTY-CHAIRMAN seconded the motion, which was carried unanimously.

Thanks were afterwards accorded to the Chairman and Directors, and to the Auditors.

The CHAIRMAN, in reply, anticipated that the Directors might have more anxious times before them than they recently had; but stated that they would do all they could to prevent the undertaking from being acquired except upon satisfactory terms. He did not anticipate that this measure would come before them at present; and the proprietors might rely upon their interests being carefully watched.

The proceedings then terminated.

BARNOLDSWICK WATER SCHEME.—For the purpose of supplying Barnoldswick with a much-needed supply of water, boring operations have been going on at Lane Heap for several months past, and the final report of the Engineers (Messrs. Brierley and Holt, of Blackburn) has been received by Mr. T. P. Brown, the Clerk to the Skipton Rural Sanitary Authority. It states that, in compliance with the Authority's instructions, the test of the yield of the bore-hole was extended three days beyond the originally specified time; ceasing at 7 p.m. on the 31st ult. At the end of the test the yield had been slightly reduced, but this was to be expected, considering the continuous pumping of a quantity of water equal to 2,098,246 gallons abstracted from the substrata. In order to show how far the pumping had exhausted the supply, and what would be the result after pumping had ceased, observations have been made, with the result that it was found that when the pumping had ceased, the water stood in the well at a depth of about 5 feet from the bottom; in two hours the water had risen 27ft. 7in. from the bottom; and in 12 hours it had risen to a depth of 73ft. 9in. This shows that, although 2,634,000 gallons of water have been abstracted from the substrata, it recoups itself, and rises in the well in almost an undiminished quantity. In practice, when the town is supplied, such severe tests as that just concluded can never be needed; a quantity of water having been pumped equal to the ordinary supply of the whole of the inhabitants for a period of 50 days.

BELFAST CORPORATION GAS SUPPLY.

PROPOSED EXTENSION OF THE GAS-WORKS—ELECTRIC LIGHTING.

At the last Meeting of the Belfast Town Council—the MAYOR (Mr. C. C. Connor) in the chair—the report presented by the Gas Committee had appended to it one by Mr. James Stelfox, the Gas Engineer, on the subject of the extensions rendered necessary at the gas-works in consequence of the increased consumption. The Committee recommended the Council to authorize the extensions indicated, and to expend thereon a sum not exceeding £30,000. The Committee had had under consideration the question of the introduction into the city of lighting by electricity; and they recommended the Council to appoint a Special Committee to procure all the information requisite for the guidance of the Council therein, and to report on the matter. Mr. Stelfox's report was as follows.

It is now some eight years since I called the attention of the Gas Committee of the Corporation to the necessity which would shortly arise for an increase in the producing power of the gas-works. At that time, as now, the prospect of a powerful opposition from the electric light was looked upon as a very serious reality; and it was agreed that the site of the present works should be utilized to the utmost extent before entering upon the construction of a new station. Accordingly, it was decided that the portion of ground at the south end of the works bounded by Ormeau Road and the Central Railway, which had been intended for an extension of purifying apparatus, should be reserved for an additional retort-house; and it is in view of the necessity for the immediate construction of this building that I am called upon to submit for your consideration a report on our position in regard to the probable demands upon us for gas in the immediate future. It has been frequently brought under notice that the increase in the quantity of gas required has been very great; amounting, on an average, to more than 100 per cent. in each decennial period. During the comparative slackness of trade for a number of years past, this increase has not been so rapid; but we may expect that, with a revival of business, the demand will continue to increase. At any rate, we should be prepared for this. As showing the rate of increase during the past, I may repeat figures which have already been submitted to you:—The gas made for the year ending June 30, 1852, was 87,870,000 cubic feet; for 1862, 173,939,000 cubic feet; for 1872, 410,000,000 cubic feet; and for 1882, 614,791,000 cubic feet; while for the year to June 30, 1889, the quantity of gas sent out amounted to 907,000.000 cubic feet. For the year preceding that in which the Corporation acquired the undertaking, the gas delivered amounted to about 420,000,000 cubic feet; and this was all made in what is now known as the old section of the works. The new section, on which the late Gas Company had expended a large sum of money, had not been brought into use; but both sections have now been worked, and their combined producing power will be fully tested during the coming winter. The total number of retorts in both sections is 902; and at present 550 of them are at work. This number will increase rapidly as winter sets in; so that in December we shall probably require every retort to maintain the supply. As no provision for a new retort-house, in time for use in the winter of 1890-91, could be made, the Committee will see that we have not only no margin in case of a breakdown, but are actually dependent on every retort being maintained in a workable condition during the winter—a task which it will be extremely difficult to accomplish, as many of the settings are already pretty far through. The retort-house which I have sketched out for the new site will add 272 retorts to our plant; and, with a view to obtaining from these the greatest amount of duty possible, I propose to have them constructed after the most approved form of regenerative settings. This will render the building somewhat more costly than our existing houses, as an elevated stage-floor will be required, owing to our being unable to excavate the space for the regenerative furnaces on account of water rising almost to the surface of the ground. The cost of this house, with retort-settings, chimney, connections, and tramways, will not fall much short of £20,000. This sum would, I think, cover the cost of paving the coke-ground, building the retaining wall, and erecting overhead cranes and tramway for dealing with the coke. A stage house like this must be worked by machinery owing to the difference in level of the retort-house and coal-shed floors. I have obtained an estimate for this, which amounts to £5800. Foundations for this work and engine-house will come up very nearly to another £1000; and the connection to the existing apparatus will cost about £500. These figures together amount to £27,300; and for this sum we should gain an increase of over 25 per cent. on our producing power. It is necessary to remind you that 25 per cent is not more than a sufficient margin to provide against ordinary contingencies; and it will therefore be desirable, at a very early period, to come to some decision as to the action to be taken in obtaining a new site for further extensions. When it is understood that parliamentary powers would be required, and that after the acquisition of the land it would take three years to lay out and construct new works, I think it will be clear that no time should be lost in coming to a decision on this most important matter. With any considerable increase in our present supply of gas, the necessity for increased storeage would begin to make itself felt. The total capacity of the existing gasholders is 6 million cubic feet—just a shade over one day's maximum consumption. By the addition of a third lift to each of the five smaller holders, the construction of which is favourable to the making of this change, an additional capacity of 2 million cubic feet could be gained at a comparatively moderate cost. Of this cost I am not at present able to form an estimate; but, as the need for this work is not at the moment urgent, I may leave it for future consideration. In conclusion, I cannot too strongly urge upon the members of the Committee the fact that the extensions referred to in this report can only be considered as a temporary relief, while provision is being made for the very great additions that will be required if the consumption increases, as I firmly believe it will, within the next few years. It must remain with them to decide to what extent they will anticipate the success of electric or any other method of lighting, as resulting in a decrease in the demand for gas. It is my duty to remind them that they are under an obligation to give a supply of gas when called upon to do so; and with this grave responsibility resting upon them, it will be for them to determine what measures they will adopt to meet it. I believe that as yet the use of electricity in any place has never resulted in a lessened demand for gas; and I see no reason to believe that such a result is now probable.

Alderman Sir J. PRESTON, in moving the adoption of the report, said the matter of the additional expenditure for the gas-works had had the most serious consideration of the Committee. It would be seen from the figures what a great increase there had been in the bulk of gas required during the last ten years; and they had now a very small margin indeed between the amount they were enabled to produce with the present plant and the quantity required by the town. Of course, as the Council knew, the electric light was "looming in the distance," and perhaps would in the future take a very important place in the city. They would all rejoice to see it; and the Corporation, in their wisdom, had resolved to acquire powers which would enable them to give every facility to those who wished to employ electricity as a lighting agent. It would be seen from the report that the Gas Committee asked the Corporation to join them in obtaining information from the best possible sources with regard to the electric lighting of the town. The Gas Committee did not wish in any way to obstruct the use of electricity; but in the meantime they asked the Corporation to support them in their efforts to continue to give a proper supply of light to the city. Even in the event of the electric light being used largely in Belfast, it would not diminish in any great degree the demand for gas; and it was absolutely necessary that their efficient Manager should be in a position to carry on the works effectively.

Mr. FINNIGAN said he considered the report one of the most important that had ever been presented to the Council. The Manager of the gas-works asked for a very large outlay to provide additional means of supplying gas; but he (Mr. Finnigan) was of opinion that no further plant should be erected until they had before them the result of the proposed Committee's inquiries with regard to the electric light. He would therefore move, as an amendment, that the adoption of the portion of the report recommending this additional expenditure be postponed until after the Committee's report had been submitted.

Mr. HENDERSON, in seconding the amendment, inquired whether any of the existing Companies had applied for permission to supply the electric light to the town.

The MAYOR said some of the London Companies had asked for permission to do so; but the Corporation thought proper to keep the power in their own hands.

Alderman Sir J. HASLETT was of opinion that the matter should be referred to a Committee of the entire Council.

Mr. FINNIGAN expressed his willingness to alter his amendment to accord with this suggestion.

Alderman Sir J. PRESTON hoped the Council would see the propriety of adopting this report. The Committee were not in the habit of bringing forward reports without having well considered them; and they had given this matter their closest and most careful attention before making their recommendations to the Council. The Manager had been considering this matter for eight years past; but it had been deferred by the electric light scare. The electric light had not, as far as they were aware, exercised any great influence in municipal lighting hitherto; and while they were waiting for the perfecting of an electric light system, it would not do for them to have an insufficient supply of gas. In conclusion, he asked the Corporation not to interfere with the Gas Committee, whose only desire was to discharge their duties for the benefit and advantage of the city.

The MAYOR, in putting the motion, said he desired to add a few words with reference to the question asked by Mr. Henderson as to the electric light. The fact was that two or three of the large electric lighting companies applied for powers to supply the electric light to Belfast; and the Corporation at once decided to keep it in their own hands, and to apply for powers on their own behalf. Of course, they would have the right, if they should think fit, to delegate their authority to any company in the first instance. In his opinion the electric light movement was not a scare, but a very grave fact, as anyone would be able to judge who had seen what was going on at Deptford In his opinion the Gas Committee had acted with great prudence in asking the Corporation to appoint a Committee to take the whole question into consideration. Pending this inquiry, which would, of course, last for some time, Mr. Stelfox reminded them that the margin between the production of gas and the quantity consumed was dangerously small. He (the Mayor) could also assure the Council that the Gas Committee had taken a great deal of trouble in going into the matter; and it was with some reluctance that they had at length made the recommendation contained in the report. He would have very little objection to the course suggested by Alderman Sir J. Haslett; and the Gas Committee might like to have this great responsibility taken off their shoulders if the proposed Committee were called to consider the matter on an early day.

The amendment was then put and lost by 11 votes to 17; the report being adopted.

At a subsequent stage of the proceedings, a Committee was appointed to consider the question of electric lighting.

THE DUNDEE GAS COMMISSIONERS AND ELECTRIC LIGHTING.

A report which has been prepared by a Committee of the Dundee Gas Commission, who were appointed to consider the question of electric lighting, has lately been published. The Committee say they resolved, in the first place, to view and investigate only the best known and most approved systems of electric lighting; and to do this they visited London and Paris. After describing the Deptford works, and the Brompton works of the House-to-House Supply Company, it is stated the Committee next visited Paris, where the electric lighting arrangements were shown to them by M. Edouillard. The report deals with the Exhibition lighting, which the Committee describe as excellent. Dealing with the installation which is being established in Paris by the Municipality, the Committee say it is situated under the markets, in a well-built and fire-proof sunk area. Being public property, no rent for the ground will be payable; and this alone will assist in the economical supply of the light. It occurred to the Committee that if electric lighting is to be introduced into Dundee, the installation should be proceeded with on the lines indicated. It was noticeable in this public installation in Paris, that there was a total absence of everything ornamental; and the Committee were impressed with the careful and practical manner in which the works had been planned and carried out, so that the light could be produced at the lowest possible rate. It appeared to the Committee to be desirable to give any information in their possession as to the cost of electric lighting as compared with gas. This had been difficult to arrive at; and must depend very much on the circumstances of each individual case. The larger the number of lights to be supplied, the cheaper would it be produced, and *vice versa*. So far as could be ascertained in London, the cost of the light from electricity equal in illuminating power to the light from 1000 cubic feet of gas was 3s. 9d. The average cost of London gas is about 2s. 6d. per 1000 cubic feet. But they say it must not be forgotten that London gas is only equal in illuminating power to 16 standard candles; whereas in Dundee it is equal to at least 25 candles. Therefore, if the value of 16-candle gas is 2s. 6d. per 1000 cubic feet, 26-candle gas is worth 4s. 0½d. per 1000 cubic feet; but the Dundee price is only 3s. 4d. per 1000 feet net. If they adopted the simple rule that the light from electricity was equal to 3s. 9d. per 1000 cubic feet of 16-candle gas, it would work out to 6s. 1½d. per 1000 cubic feet of 26-candle gas. Putting this figure against the above quoted 3s. 4d. (being the Dundee price), they had a difference in price in favour of gas in Dundee of 2s. 9½d. per 1000 cubic feet. The fact, they observe, must not be concealed that the electric light possesses many advantages over gas; notable amongst these being the total absence of any vitiation of the atmosphere of the apartments lighted, and the almost complete absence of any heating power. These are doubtless most valuable qualities; but whether they are worth the difference in price indicated, is a

question the Committee cannot answer. The Committee considered that in resolving to supply the new light themselves the Gas Commissioners, who represent the public, and the public alone, act wisely, as the lighting in Dundee should be done by the Gas Commissioners. They recommend this the more strongly because there is ample space at the gas-works for the erection of such buildings as would be required for accommodating the machinery necessary for producing the light; and they also believe that the electric light could be produced most economically under the same management as exists at the gas-works. The Committee have satisfied themselves the question is no longer one of experiment—it is a reality, and one which at once is a competitor of coal gas; but it is difficult to say how near the future may be when electricity will be adopted for lighting purposes, and also for the transmission of power.

A Special Meeting of the Dundee Gas Commissioners was held on Monday of last week—the Lord Provost in the chair—to consider the foregoing report.

Ex-Bailie Gentle, a member of the Committee, explained that, as stated in the report, the deputation had visited the electric lighting works at West Brompton, the district to be supplied from which was nearly as large as Dundee. Plant had been put down there which would cost £37,000. The Company had secured suitable ground, which would enable them to extend their plant from three to twelve engines, or quadruple the present power, which they considered would be sufficient to supply the whole district. There was one thing the members of the deputation noticed particularly in connection with the choice of a site for electric lighting works, and that was that the promoters laid great stress on having them in a position where a cheap supply of coal could be had. This was one of the reasons why the Committee recommended that the site of the Dundee Gas-Works should be utilized for the production of electricity, because they had the site, which was as suitable as could be wished, which they had paid for, and on which they could extend their works without disturbing the neighbouring proprietors. They would also have cheap coal; for the reason that haulage was reduced to the lowest figure. With regard to the management, while it would undoubtedly be necessary to have a practical electrician, he did not think there was anything in connection with the works that the Gas Engineer (Mr. J. M'Crae) could not undertake to superintend; so that if it were arranged that the Commissioners should supply the electric light as they did gas, the expense would be reduced to a mimimum. He did not think there could be a doubt in anybody's mind that it was a wise thing for the Corporation to purchase the gas-works. If it were wise 20 years ago to acquire the gas undertaking and hold it for the public good, he thought it would be very unwise to-day for them to permit a company to come into the town and obtain powers for lighting purposes, because the company had no means of doing the work cheaper than the Commissioners. While an apparent saving might be made, in the end the probabilities were that a very much higher price would have to be paid by the ratepayers. The Committee were quite unanimous, as far as the quality of the electric light was concerned, that it was a great success. In their report they had stated that the difference in price, so far as they could learn, would be very considerable, and for a time would prevent the general adoption of electricity. Improvements would probably be made which would inevitably reduce the cost. There had been great improvements in the manufacture of gas lately; and he supposed there was never a year in which the Commissioners had not added to capital expenditure for the purpose of securing improvements in the system of manufacture. In addition to this, they had always had a continued increase in the consumption of gas; so that they had not only to add to their capital expen diture in connection with the necessary improvements, but also for the purpose of making the additional quantity required. If the electric light business was gone into by the Commissioners, possibly it would mean that they would not need year by year to add more to their capital expenditure than they had done in the past ten years. If the electric light was employed for a portion of the town, it would prevent the necessity of erecting new works to produce the increased quantity of gas, because the consumption would be reduced to the extent of the relief given by the part that was lighted by electricity. On the whole, he did not think the Commissioners would be taking up any wild project if they were to resolve to keep in their own hands the supply of electric light. In his opinion, there could be no doubt of the wisdom of the Commission resolving to obtain powers to do so. If the Commission found that they could do better by entering into a bargain with a private company, he had no doubt they would be careful to make the best bargain they could in the interests of the community.

After some conversation,

The Lord Provost said his opinion was that it would not be advisable to allow any company to come into Dundee and take the supply of light into their hands; and therefore he would move—"That this meeting resolves to promote a Bill in the ensuing session of Parliament, either alone or jointly with the Magistrates and Town Council of Dundee and the Commissioners of Police of the burgh of Dundee, or either of them, as may be arranged, for the purpose of enabling the Gas Commissioners as now existing, or as their constitution may be altered or enlarged, to erect and maintain electric lines and works, and to supply electric energy within the district of the Dundee Gas Commissioners, or some parts thereof, on such terms and subject to such safeguarding provisions as may be afterwards resolved on; that the said Bill may also provide for the alteration or enlargement of the constitution of the Gas Commissioners; and in the meantime that the Clerk be directed to adjust and publish the necessary notice for the Bill."

Ex-Bailie Gentle seconded the motion, and it was at once agreed to.

It was also resolved to consult with the Town Council and Police Commissioners on the subject, with a view to the adjustment of details as far as possible to the satisfaction of all concerned.

A Meeting of the Gas Commissioners was held last Friday for the election of five representatives on the Commission. One of the retiring members (Mr. Longair), who stated that he did not wish to be re-elected, gave some interesting particulars in regard to the gas undertaking. He testified to the thorough maintenance of the gas-works during his three years of office, and to their present efficiency. They had been skilfully managed; and the result was that the price of gas was this season lower than it had ever been in Dundee. Passing on to refer to the question of electric lighting, he remarked that whatever else might be thought of the report which had lately been presented to the Council, he was struck by the startling statement that the cost of the electric light would be something like double the cost of gas. This statement had surely been made in error; or in any case it was very misleading. He had taken the trouble to compare the cost of gas and electricity in his works, and he would be glad to state his experience. The figures referred to an installation of 500 lamps of 16-candle power to burn 1000 hours:—Electric lighting: Cost of installation, £850; separate engine, boiler, &c., £300—total, £1150. Interest, working expenses, renewals, &c., £248 15s. Gas lighting: Cost of 500 burners, interest, and depreciation, £32 10s.; cost of 500 3-feet burners, less discount, £249 7s. 6d.—total, £281 17s. 6d. There was thus a difference in favour of electricity of £43 2s. 6d. This was only the beginning of the question, however; for electricians claimed that it required a No. 5 burner to give a light equal to a 16-candle lamp. A No. 5 burner consumed from 5 to 6 cubic feet per hour, and the cost of gas to give the same light as the electric lamps would be increased by £175 by the use of a No. 5 for a No. 3 burner. Then, in many works no separate engine was required. In his case he had ample power; so that £15, the interest on £300 he had allowed for a separate engine, &c., was saved. They had also to bear in mind that 1000 hours for 16-candle lamps was the minimum of light in efficiently-made lamps burning from 2000 to 3000 hours. Moreover, the maintenance of the electric light was slight; the only wear and tear being on the commutator of the dynamo, the brushes, and lamps. Altogether, he made out the difference in favour of electricity to be £233 2s. 6d. on the installation in question. Instead of the electric light being twofold the price of gas, he held that it could be made and distributed in all parts of the city at a cost not exceeding that of gas. He believed a Corporation could undertake to supply electricity at a price not exceeding that of Dundee gas, and at the same time be able to declare a dividend of 10 per cent. This was a more hopeful aspect of the question than the statement made in the report. Speaking from two years' experience, he could testify that electricity was better, brighter, cheaper, and safer than the ordinary systems of gas lighting. He did not favour the proposal to have the electric light works within the gas-works, for the simple reason that it would be a great drawback to have the works a mile distant from the centre of the city, entailing the additional cost of wires to bring the current. In his opinion it would be better to subdivide the city into areas or districts. Mr. Longair was heartily thanked for his interesting statement.

GAS WORKMEN AND THE LABOUR QUESTION.

Continuing our record of the progress of the movement among gas workmen for improved conditions of labour, we have to report that the dispute between the stokers at the Darlington Gas-Works and the Gas Committee of the Corporation was satisfactorily settled last Tuesday. A deputation from the men waited upon the Committee on the evening of that day, and discussed with them the position of affairs; the result being that the Committee presented the following proposals:—(1) That the standing wages be 35s. per week, or 5s. per day, Sunday work to be limited to three draws; if a fourth draw be necessary, the same to be paid for additionally. (2) Good Friday and Christmas Day to be each paid for as two days; if no work be done, each man to still receive one day's pay. (3) This arrangement to be good and binding for twelve months. The men retired to consider the proposals; but shortly afterwards returned, and expressed themselves willing to accept these terms. After thanking the Committee for the way in which they had received them, they withdrew. Formerly the men received 33s. per week in the summer time and 34s. 7d. in winter, including Sundays. The men employed at the Coxside works of the Plymouth and Stonehouse Gas Company have applied to the Directors for a readjustment of their conditions of labour and an increase of remuneration; and the Deputy-Chairman (Mr. R. H. Snow), the Secretary (Mr. J. Thomas), and the Engineer (Mr. J. T. Browning) were deputed to confer with representatives of the men on the subject. This they did last Wednesday, when the various points mentioned in the application were discussed in a reasonable and amicable way, and suggestions were made on both sides which lead to the anticipation that a settlement on terms which can be assented to by the Company and the men will ultimately be arrived at. At the meeting of the Directors to be held on Thursday next it is hoped that it will be possible to come to a decision which will render agitation of any kind unnecessary. The Directors of the South Shields Gas Company, in reply to the demand of the workmen for shorter hours and increased wages, have offered eight-hour shifts instead of twelve, 24 retorts instead of 28, and payment of 5s. per shift, or to continue 12 hours as at present with 6s. per shift; other workmen to receive corresponding concessions. These terms have been declined by the men. The workmen at North Shields last Thursday sent in an application demanding shorter hours of employment, increased wages, and improved conditions of work. The stokers in the employ of the Halifax Corporation have at length come to terms. They will continue to work eight-hour shifts, but separate firemen are to be put on, each to look after eight fires and clinker four fires; while the stokers will in future have no fires, but each man will have to draw and charge 28 retorts each shift. The men employed at the Smethwick Local Board Gas-Works having joined in the labour movement, lately approached the Gas Committee on the subject; and after careful consideration of the proposals of the men, they recommended the Board to grant the following concessions:—Working hours to be eight instead of twelve; time-and-a-half for Sunday labour; stokers to have charge of 20 retorts instead of 24; coal wheelers to wheel coal for 70 instead of 84 retorts, and slack for five instead of six fires; the re-arrangement to come into operation on the 15th inst. Immediately after the meeting of the Leeds Town Council last Saturday, the members of the new Gas Committee were called together, and the recommendations of the Sub-Committee in the matter of the dispute between them and their *employés* laid before them. The men were fixed in their determination to strike if their demands were not granted; and the outcome of the Committee's deliberations was the concession of those demands.

The Charges for Water in the Wakefield Out-Districts.—The Wakefield Rural Sanitary Authority recently made formal application to the Local Government Board, "to determine the reasonable cost at which a supply of water may be required to be furnished to houses in the contributory places of Alverthorpe-with-Thornes, Crigglestone, Sharlston, Stanley-cum-Wrenthorpe, and Warmfield-cum-Heath, which are without a proper supply;" and the Local Government Board directed that an inquiry should be made into the subject-matter of the application. This was held last Wednesday week by Mr. Arnold Taylor. It was stated in the course of the proceedings that the supply mains would have to be laid to these places, excepting to Alverthorpe-with-Thornes, which has hitherto been furnished with water by the Wakefield Corporation; but the Rural Sanitary Authority have now taken over the pipes. The scale of charges that was adopted for dwelling-houses in Alverthorpe and Warmfield-cum-Heath, per half year, according to rateable value, was as follows:—£3 and not exceeding £5, 5s. 5d.; £5 to £7 10s., 6s. 6d.; £7 10s. to £10, 7s. 7d.; £10 to £12 10s., 8s. 8d.; £12 10s. to £17 10s., 9s. 9d.; £17 10s. to £25, 10s. 10d.; and above £25, at the rate of 5 per cent. per annum. The same scale was proposed for Stanley-cum-Wrenthorpe; but in this case there was some opposition. For Crigglestone and Sharlston the following scale per half year, according to rateable value, was agreed to:—£3 and not exceeding £5, 6s. 6d.; £5 to £7 10s., 7s. 7d.; £7 10s. to £10, 8s. 8d.; £10 to £12 10s., 9s. 9d.; £12 10s. to £17 10s., 10s. 10d. £17 10s. to £25, 11s. 11d.; and above £25, 5 per cent. per annum.

RECENT SALES OF GAS AND WATER SHARES.

At the Auction Mart, Tokenhouse Yard, last Tuesday, Mr. Alfred Richards sold by auction some shares in the undermentioned gas and water undertakings. The prices realized for the different shares were as follows:—£370 ordinary stock in the Herne Bay Water Company, £60 per £100 stock. Eighteen ordinary "B" shares of £10 in the Grays Gas Company, £11 15s. each. Thirty-eight original £5 shares in the Harwich Gas and Coke Company, £8 each. In the Ascot District Gas Company 25 original £10 shares sold at £7 10s. per share. In the Carshalton Gas Company 25 original £10 shares realized £16 each. In the Walton-on-Thames and Weybridge Gas Company 25 original £10 shares sold for £14 each. £75 "C" capital stock in the Barnet District Gas and Water Company realized at the rate of £172 10s. per £100 stock. Two £10 fully paid "D" shares, and six like shares, £4 paid, in the same Company fetched respectively £12 15s. and £5 17s. 6d. each. Two £10 fully paid shares in the Brentwood Gaslight and Coke Company were knocked down at £18 7s. 6d. each; and two £5 shares (£4 paid) in the same Company realized £7 10s. 6d. each.

At the same place, on Thursday, Mr. Richards sold £17,983 of perpetual 4 per cent. debenture stock of the West Ham Gas Company, at prices ranging from £106 to £109 per cent.; the total amount produced being £19,167, the amount authorized by the Company's Act of last session.

Last Thursday there were submitted for sale by auction at Weymouth £450 of ordinary "A" stock in the Weymouth Consumers' Gas Company, and five ordinary £10 shares (£7 paid) in the same undertaking. The stock, which is entitled to a maximum dividend of 10 per cent. per annum, fetched prices varying from £176½ to £180; the average being £178 1s. 8d. The shares, which carry a maximum dividend of 7 per cent., realized £10 12s. 6d. each.

At a recent sale by auction, by Messrs. Bevan and Phennah, at Wrexham, the following prices were realized for stock and shares in the Wrexham Gas and Water Companies:—Six lots of £50 consolidated (10 per cent.) stock of the Gas Company, £103 per lot; three lots, each of ten 7 per cent. fully-paid shares, at £149 each, and two other lots at £148 each; ten similar shares, £4 paid, selling for £62. The Water Company's stock fetched the following prices:—A parcel of £70 consolidated (4½ per cent.) stock went for £86; lots of ten 5 per cent. preference shares (£10) were knocked down at £12 10s. per share; ten fully-paid 4 per cent. preference shares fetched £102, and a like number on which £6 had been paid sold for £63; and two lots of £100 preference stock (4½ per cent.) fetched £115 each.

At a recent sale of shares in the Gravesend and Milton Gas Company, original shares fetched, on an average, £44 18s., and new shares £33 11s. each. A few of the former shares were sold for £47 each—the highest price ever obtained for this stock. In all, 93 shares of the two classes were sold; the total amount realized being £3696.

It was thought that the recent formation of a local Electric Light Company, at Rochester, and the installation of the electric light which followed, would have a depreciatory influence on the shares of the Rochester Gas Company. Any apprehensions which may have been felt on this point must have been dispelled by the high prices realized for shares in this undertaking recently disposed of at a public sale by Mr. Franklin Homan. Five £50 "A" shares, carrying a dividend of 10 per cent., realized £114 per share; six similar shares fetching £114 10s. each. Eight £12 10s. "B" shares (7 per cent.) were disposed of for £21 per share; four similar shares realizing £20 15s. each. Fifteen £3 6s. 8d. "C" shares (7 per cent.) were disposed of for £5 15s. per share. Eight £8 10s. "D" shares (10 per cent.) realized £20 10s. each; and four similar shares, £20 15s. each.

Last Thursday Messrs. Luddards and Stansfield submitted to public auction at Bradford a large number of shares in various Companies, among which were nine original £10 shares in the Clayton, Allerton, and Thornton Gas Company, which sold at £19 per share; five "A" £10 shares produced £17 17s. 6d. per share; and three "B" £10 shares (£5 paid), realized £10 10s. per share. A parcel of £300 stock in the Pudsey Gas Company sold at £19¼ per cent. Some £5 shares (£3 paid) in the Calverley District Water Company produced £5 10s. On the same day, Messrs. T. S. Best and Harris sold, at Bradford, 10 "B" £10 shares (£5 paid up) in the Clayton, Allerton, and Thornton Gas Company, at £10 10s. per share. Twenty-five "B" shares (£10 fully paid) in the Dudley Gas Company were disposed of at £20 17s. 6d. each. £300 of stock in the Newcastle and Gateshead Gas Company, on which the last dividend paid was 9½ per cent., was sold at £184 per cent.

THE DANGERS OF OVERHEAD ELECTRIC WIRES.

The New York Correspondent of the *Daily News* has sent to that paper the following account of a remarkable accident which occurred in the city early on Monday last week from contact with an electric light wire:—"A telephone wire, worn by rust, broke and fell from the high pole on which it was stretched in Fourth Avenue, and, in falling, dragged with it an electric lighting wire, which then lay in a loop across the roadway. Thomas Whelan, driving a waggon, came down the avenue, and his horse stepped upon the fallen wire. The animal stopped short, then sprang with all its four feet into the air, and fell motionless. The concussion threw Whelan over the horse's head into the street. As he arose, bewildered by the fall, but unhurt, he steadied himself against the prostrate beast. A tremendous shock then threw him off his feet into the gutter. Whelan saw sparks flying in all directions as he fell; but, believing they were creatures of his fancy and the effect of his fall, and failing entirely to comprehend the situation, he felt for the horse's head in the darkness, and got hold of the bridle. The shock this time flung him still farther away. Whelan then at last understood the significance of the flashes of light, and lay still and shouted for help. Two men who were near heard his cries and ran to see what was the matter. In the darkness of the avenue—for no electric lights were burning—they saw the tramway track and the horse emitting flashes of blue flame, and sparks were spurting here and there all about in unexpected places. The horse was evidently stone dead. A smell of burning flesh was perceptible half a square away. A crowd was gathering and the avenue waking up. The police were summoned, and a sergeant with two men appeared. The sergeant set a guard at each turning to keep passengers out of danger. Before enough had responded to carry out the precaution, however, a party of men came down the avenue. The sergeant started across the avenue to keep them off. It was still too dark to see where danger threatened; and the sergeant, feeling his way with his baton, struck the wire with his head. It caught him across the forehead, and sent him to the pavement as if he had been shot. A policeman, seizing the sergeant's foot, tried to pull him away. The shock which he himself received sent him sprawling; but he resolutely caught hold once more, and drew the prostrate sergeant out of Death's path. His whole body tingled and shivered with the electric current as he made his effort; but he succeeded, and the sergeant recovered slowly. The dead horse was still burning steadily in the roadway. Finally, it occurred to someone to run to the Electric Lighting Company's workshops. Men encased in rubber boots and gloves came, and the wire was at once cut and pulled down from the pole; but it still blazed and spluttered in the gutter for half an hour. It is not strange that nobody here contends any longer that electricity is not sufficiently deadly to be used in the execution of criminals."

Telegraphing on Wednesday, the same authority said the foregoing story might possibly, in some of its minor details, contain "touches of the narrator's fancy;" but that the truth of the main facts was unquestioned. Electricians in New York admitted this, but stated that the assertions that sparks flew about the street near the horse, or that flames appeared about the extremities of the workman who was recently killed whilst working on a pole, were absurd. There might be smoke, but there could not be any flame. Next day he sent the following statement in regard to the accident, by Mr. Harold P. Brown, who has published some interesting statistics in connection with accidents due to electric installations:—"Such occurrences have become very common since the introduction of the high-tension alternating current. The explanation is simple to anyone having experience with the peculiarities of that deadly current. In the first place, although it was not at the time raining, it had been, and everything was still saturated with water. The rusted telephone wire had fallen into the street, and trailed against the insulated wire carrying the alternating current. The earth-connection thus formed was but a partial one; and when the horse, shod with iron, struck the wire and pulled it taut, its body, being more completely connected to the earth, shunted sufficient current through it to produce death. It fell upon the wire; and it is not at all unlikely that the contact of the rusted wire against the tramway rail may have allowed sufficient current to pass to finally produce an arc. The driver twice touched the horse, which, when lying on the pavement stones, no longer formed as perfect a connection to the ground as when standing. A portion of the current was diverted through him, though not enough to cause serious injury. The police sergeant then came in contact with the wire between the horse and the pole, and deflected sufficient current to knock him down and burn his forehead. The accounts indicate that he, too, fell upon the wire; and his assistant in pulling him off received his quota of electricity. This may seem very improbable to English readers. It did so to us at first; but there have been so many similar accidents in which an alternating current has been divided among several living beings from a partially-grounded wire, that we know it is only too true. One case out of a dozen will suffice to exemplify this: On the morning of Feb. 5, 1888, before daylight, a driver of a grocer's waggon in a prominent street in Buffalo, N.Y., saw his horse fall to the ground, which was covered with snow, and wet sleet was falling. He tried to pull the animal up, but failed; and when he struck it with his wet whip, he received sufficient shock to throw him backwards into the waggon. His cries brought to his rescue a man who seized the horse by the bridle, and was instantly killed. Subsequent examination showed that a telephone wire had broken. One end fell into the street, while the other rested against an insulated wire carrying an alternating current of 1000 volts. It was upon this broken telephone wire that the horse had stepped."

As it was thought that the story of the *Daily News* Correspondent would be sure to create a great deal of excitement in London, representatives of the *Pall Mall Gazette* were despatched to inquire in authoritative quarters as to the possibility of such an incident occurring in the Metropolis. Calling at the offices of the London Electric Supply Corporation, one of these gentlemen had a brief conversation with the Earl of Crawford on the subject of the story. "Exaggerated, grossly exaggerated," said his Lordship, on glancing through the report. "As soon as the wire was to earth, as it must have been when the horse fell upon it, the current would return through the earth to the dynamo. All the same, it illustrates the danger of using naked wires. Every company in London who have overhead wires have them carefully insulated. Here is a sample of our overhead cables. The copper wire has a thick covering of india-rubber and other insulating material. To prove its absolute safety, I grasped the cable, in the presence of the Board of Trade Inspectors, when there was a current of 2000 volts. I cannot say there are absolutely no naked wires in London; but the Board of Trade have ample power, under the Acts of 1882 and 1888, and all Provisional Orders, to enforce complete insulation, and they no doubt take good care that there is no danger. In America there is no law to compel the companies to take that precaution; and they apparently do as they please." "Then," said the interviewer, "the people of London need not be in a state of alarm?" "No," replied his Lordship; "certainly not." In conversation with another practical electrician, this point was emphasized, that in London there is always a second cable provided for the return current, instead of depending upon the earth. Had there been this second cable in New York, the accident could not have occurred.

In the course of a recent article in the *North American Review*, Mr. Edison expressed himself as follows on the danger of high-tension alternating currents:—"There is no known insulation which will confine these high-tension currents for more than a limited period. The dangers of such circuits are not restricted to the wires which convey the high-tension currents; but other wires conducting harmless currents are liable to be rendered as deadly in effect as the former. It is evident also that a single wire carrying a current at high pressure would be a constant menace to the safety of all other wires in the same conduit. Even though these dangerous wires be placed in separate tubes in the same conduit with other tubes, the risk is not diminished. Several instances are on record, and one I have particularly in mind, showing the possibility of serious accident through the crossing of wires. Near the corner of William and Wall Streets, in New York, the underground conductors of the Edison Illuminating Company became crossed, and the current which was passing through them at a pressure of only 110 volts melted not only the wires but several feet of iron tubing in which they were encased, and reduced the paving-stones within a radius of 3 or 4 feet to a molten mass. The crossing of wires in this way means a concentration of several hundred horse-power of energy in a small space. What would have been the effect of such a crossing as I have described had the pressure been 2000 instead of 110 volts, and what also would be the effect if it were to occur in a conduit in close proximity to hundreds of telephone wires and those of other electric lighting systems? The numerous accidents which have occurred in New York during the past year, show to a very large extent the operation of time upon the insulating material which surrounds these wires. When the poles were first erected, the current was to a certain extent successfully confined; but the air is doing its work. Abrasions are more easily made; and without the adoption of genuine methods of control, accidents may be looked for in larger numbers as time goes on—due not only to deterioration of insulation, but to the multiplying of electric circuits to supply the popular demand for the electric light."

An inquiry has been held into the circumstances attending the death of the linesman Feeks, which was recorded in the JOURNAL a fortnight ago. The Coroner (Mr. Schultz) had the assistance of two expert electricians; and the investigation brought out a mass of valuable information. One witness testified that he had traced to a Brush day circuit the wire which caused the fatality. The result of the inquiry has not yet reached us.

NOTES FROM SCOTLAND.

(FROM OUR EDINBURGH CORRESPONDENT.)

EDINBURGH, *Saturday.*

Owing to the length of my "Notes" last week, I was unable to do more than mention that the Edinburgh and Leith Gas Commission had agreed to advance the wages of their *employés*. I think it but right, in view of what I wrote three weeks ago, to say that the difficult task which they had before them has been accomplished with credit. The Commissioners allowed themselves to be guided by the men in charge of the works, instead of, as on the last occasion, coming between them; and the result was that Mr. Mitchell was able, while convincing the Commissioners that an increase was not out of the question, to persuade the men that less than they asked was sufficient. The truth is that the Edinburgh wage has for long been higher than is paid in other gas-works in Scotland; and, as a consequence, the staff of men is a good one. It would not do now, when increases are being given in other places, to let the high standard down in Edinburgh; and as every consideration dictated concession, it is satisfactory to see both sides conceding. The men have obtained a substantial increase, and with that they are satisfied, and have agreed to give up their claim for time-and-a-half for overtime, including Sunday. The eight-hour day, I may say, has been the rule in the Edinburgh works for a long time.

The municipal elections are now over; and so far as can be seen, they have not produced much that which affect the gas industry. Perhaps what will ultimately be the most important result is the retirement of Mr. Smith Clark from the Edinburgh Town Council, which means that his services at the Gas Commission will also soon be lost, and the effect of that may be that now he is free from office, he may take up the claims of electric lighting, for which he has all along appeared to have a warm side. If he do so, and his efforts in that direction be as persistent as they were in opposition to the gas transfer, lively times are in store both for the Town Council and the Gas Commission. The next most important circumstance is probably the almost clean sweep of sitting members which has been made at Perth. This will more or less affect the *personnel* of the Gas and Water Commission; but the policies of these bodies are not likely to be seriously affected, except in so far as, for a time, a spirit of so-called economy may be expected. The Ratepayers' Association, who called themselves into existence to a large extent to protest against increases in the remuneration of city officials—chiefly of the gas-works—have been mainly instrumental in returning the new members to the Town Council; and consequently there is a remote possibility that an attempt may be made to try and reduce salaries and wages. In Dundee the question of most importance is the amendment of the constitution of the Commission—a step the necessity for which is admitted. In Aberdeen the elections did not turn upon any question connected with gas or water.

The Dundee Gas Commission last Monday had a long discussion upon the subject of their proposed electric light venture. Ex-Bailie Gentle urged the scheme in terms of the report of a deputation which was sent to inspect electric lighting stations in other towns. Taking the West Brompton station as his model, he recommended that the site of the Dundee station should be the gas-works, where coal could be laid down at the least possible cost. With regard to the conducting of the business, he thought they would require to have an electrician, but that there was nothing in connection with the works with which Mr. J. M'Crae, the Gas Manager, could not undertake to superintend. By that means they would be able to reduce the cost of electric lighting to a minimum. It would be unwise to allow a Company to come into the city and supply electric light, because they could not do it any cheaper than the Gas Commission. Mr. Gentle appeared to find comfort in the thought that if they introduced electric light, they would not require to expend capital in extending the gas-works, to meet an ever-increasing demand for gas, because relief would be given by the new light. A rather knotty question was put by Dean of Guild M'Grady as to whether the deputation had taken the cost of lamps into account, in their comparison of prices, and it did not receive a very satisfactory answer. The Dean pointed out that an incandescent lamp lasted 1000 hours, that gas-burners could be used longer, and that the cost of a gas-burner was a penny, whereas the cost of an incandescent lamp was 2s. 6d. The reply was that this was merely a question of detail; and that with gas, burners, meter-rents, &c., had to be taken into account. Lord Provost Hunter tabled a motion to the effect that they promote a Bill in the next session of Parliament, authorizing them to put down lines and works and to supply electric energy in Dundee "or some parts thereof;" and this was adopted. The Bill will also, in terms of the motion, deal with the alteration of the constitution of the Commission, so as to make it more representative of the community than it is at present. This is a subject which has been coming to the front of late; and the Lord Provost declared himself in favour of it. At present the Town Council elects only seven out of 21 members; and the proposition has been made that this number should be increased to 12, so as to give the Corporation a preponderance. The Commissioners held their monthly meeting on Wednesday, when the assurance was given by the Lord Provost that a joint meeting between the Commission, the Police Commissioners, and the Town Council would be held immediately, to settle what the provisions of the Electric Lighting Bill are to be. A letter from the stokers at the gas-works was read, thanking the Commissioners for advancing their wages by ½d. per hour, and accepting the increase till June next. A motion by Mr. Henry Robertson was agreed to, asking the Finance Committee to consider how to reduce the debt upon the gas-works. If the Commissioners would condescend to take a suggestion from me, I should advise them to apply their electric lighting profits—when they earn them—to that purpose.

(FROM OUR GLASGOW CORRESPONDENT.)

GLASGOW, *Saturday.*

A member of the Ayr Town Council (Mr. Morgan) recently told his constituents that they must all be pleased that the proposal that was made some time ago to purchase the works of the Ayr Gas Company was not adopted, considering the fact that electric lighting was making such enormous strides. He went on to say that the question was likely to be before the Council and the community next year; and it was therefore worth while to give consideration to the subject for a few minutes. They should know, he said, before adopting any scheme of electric lighting: (1) Had electric lighting been a success? and (2) could it be supplied at a cost not greater than that at present paid for gas? He referred to the declarations of Mr. Edison and M. Moucel, whom he spoke of as the two greatest authorities on the subject; and said that they had stated that nothing was more certain than that in the near future gas would be superseded by electricity for lighting purposes. Mr. Morgan made prominent mention of Taunton, Eastbourne, and Brighton, in respect of what they had done in the way of adopting the electric light; and then he told his audience what was being aimed at in the same direction in the town of Bedford, which was not so large as Ayr. The gas account for public lighting in Bedford last year was £1437, against £1270 in Ayr—which was much less than the estimated cost of electricity. But it had to be explained that the installation (costing £15,000) would not only light the street lamps, but also supply 4500 incandescent lamps for private lighting, the revenue from which, it was believed, would leave a balance in favour of the Corporation. Mr. Morgan admitted that the Bedford Corporation Committee of inquiry might have made a sanguine estimate. I think that is very probable; and I have not yet learned that Bedford has done anything in the way of acting on the recommendation of the Town Council Committee. The speaker considered that an installation for his town would cost £18,000. But he held that there was ground for the belief that the cost of the new light, in a few years, would be little more than the cost of gas. Referring to the immediate advantage attending the proposed change, he said that at present there are in Ayr 673 public lamps, which are equal to about 14,000 candles, whereas 100 electric lamps would be equal to 120,000 candles; so that the gain in lighting power would be 106,000 candles! Such facts (?) and figures were, he said, worthy of consideration; and he recommended that a Committee should be appointed for the purpose of making full inquiry on the subject and reporting to the Town Council before any application should be made by that body for powers under a Provisional Order. If anything is done in the way of publicly adopting the electric light in Ayr, the Gas Company will be very much to blame by continuing the policy of exacting an unusually high price for the gas—which, for the past two or three years has been 4s. 7d. per 1000 cubic feet, whereas in the town of Kilmarnock, which is in the same county, the price is only 3s. 6½d. per 1000 feet.

At the last meeting of the Kilsyth Police Commissioners, a letter was read from the *employés* at the gas-works soliciting an advance of wages. After the matter had received due consideration, it was agreed to raise the wages from 1s. to 2s. per week. The Manager's pay was also advanced 2s. per week.

It was reported to a meeting of Paisley Town Council, held yesterday, that an application for an increase of wages had been received from the stokers and wheelers employed in the Corporation Gas-Works. On the recommendation of the Gas Committee, it was agreed to grant an advance of 3s. and 1s. 6d. per week respectively.

Ex-Bailie Milloy, of Rothesay, is evidently very much dissatisfied with his colleagues in the Town Council agreeing to erect a new gasholder, at a cost of £2000, on the site now occupied by the gas-works, which, without question, was a mistake. Messrs. Hanna, Donald, and Wilson, the contractors for the holder, had offered to erect at the time entirely new gas-works for the sum of £6000. Suitable ground for new works could have been procured at the back of the town; and that might not be so easily obtained at any future time. The new holder was, he says, to effect a great improvement in the way of giving them cheap gas; but instead of that it was very much dearer, because inferior coal had been used, and consequently the gas was not so good as it ought to be. Mr. Mackay, one of Mr. Milloy's colleagues, has been denouncing the system of "robbing Peter to pay Paul," as carried out by the Rothesay Gas Commissioners, who seem to make the gas consumer pay more than his fair share of the upkeep and improvements of the town. The profits of the gas-supply undertaking, instead of going to reduce the price of the gas to the consumer, are applied to meet the expenditure of the other Trusts, which means a great annual saving to the large proprietors. In the event, for instance, of it being resolved to spend a sum of £1000 for the benefit of the town, the landlords would have to pay their fair share of it, which was one-half; but if it was paid from the gas profits, the whole burden fell on the consumers. This he holds to be an injustice and an insult to the common sense of the community. He is also against the deposit of 5s. being charged, as it leads to the refusal or impossibility of poor householders to use gas. In going round his own district, he says he has been astonished at the preference shown for paraffin oil; and seemingly some of the residents in the richer districts also burn this illuminant, and thus avoid the taxation. The same reforming Gas Commissioner is in favour of abolishing the charge for gas-meters, which should remain the property of the Gas Committee. I may mention that something like £3000 has been taken out of the gas profits during the past five years, and spent on general improvements. It is also worthy of remark that the past year's profits were sufficient to have enabled the Gas Commissioners to reduce the price of gas to the extent of 9d. or 10d. per 1000 cubic feet. To one of the large consumers that would have meant a saving of about £30. The gas made last year amounted to 28,623,700 feet, as compared with 26,543,900 feet; being an increase of fully 2,000,000 feet.

The Convener of the Glasgow Municipal Lighting and Watching Committee says that a new era may arise in the Lighting Department when the electric light has been more perfected for use. When that takes place, the Committee will not, he says, be slow to take advantage of it.

Yesterday, on the Glasgow Stock Exchange, the ordinary shares of the Partick, Hillhead, and Maryhill Gas Company changed hands at £5 5s. per share, while the preference shares realized £5 12s. 6d. per share.

This week's pig iron market has been characterized by a rapid advance in the price of Cleveland iron, which has been higher than that of Scotch iron—a condition of things never formerly occurring in the history of the Cleveland iron trade. Yesterday the closing price for Scotch iron was 60s. per ton cash; and that of Cleveland iron 60s. 7½d. per ton. The price of hematite iron has reached 72s. per ton cash, and some Scotch special brands are quoted at 75s. and 76s. per ton f.o.b.

The Glasgow coal trade continues to be very strong. Prices have advanced all round; and in various districts another advance of wages has been granted to the miners.

THE BARNSLEY GAS COMPANY AND THE PRICE OF GAS.—Arrangements were made for a deputation of ratepayers to wait upon the Barnsley Town Council last Saturday, and present a largely-signed requisition, urging the Corporation to apply for an order from the Quarter Sessions to audit the books of the Gas Company. The increase in the price of gas is still creating a good deal of interest.

SINGAPORE GAS COMPANY, LIMITED.—The half-yearly meeting of this Company will be held to-day, when the Directors will report that during the six months a new gasholder and tank have been completed, and gas has been supplied from the holder in a satisfactory manner. Forty-eight additional public lamps have been lighted; and an order for a further number is shortly expected. The abnormally high rate of freight to the East, caused by the colliers' strike in Australia, and a partial strike in England, has, they state, considerably increased the cost of coal. Since the termination of the strike, freight has been much lower. The sales of residuals have been good; and the collections have been satisfactory. After charging profit and loss account with the usual writings off, and placing £500 from the reserve fund to the credit thereof, there remains a net available balance of about £2290. Out of this sum, the Directors recommend the declaration of a dividend at the rate of 7½ per cent. per annum, less income-tax, the balance (£17) to be carried forward to the next half year's accounts.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 9.

Sulphate of Ammonia.—There is no change either in the values or the position. The extreme dulness of nitrate has caused some of the Continental sulphate buyers to assume a passive attitude; but spot parcels cannot be said to go a-begging, the demand from one source or another remaining tantamount to the present production. That there has been considerably more offering cannot be denied. But the strike of London lightermen will, by increasing the demand for country parcels, probably keep our market steady; and the increasing production is likely to be absorbed by the Continental requirements, which remain to be filled between now and the end of the year. The price of sulphate to-day is £11 16s. 3d. to £12 at the various ports; nitrate on spot, 8s. 4½d. At the same time last year, the figures were: Sulphate, £12 2s. 6d. to £12 5s.; nitrate, 10s. 3d. From which it is plain that it is most difficult to find a rule for regulating the value of the two commodities, and it will probably not be until the spring that the greater cheapness of nitrate will have an effect upon sulphate.

LONDON, *Nov.* 9.

Tar Products.—The recent advances in these are maintained. Pitch is still held for 30s. to 36s.; although but little actual business is reported at the higher rate. Benzols have improved during the past week; and there is every probability of further advances, especially for forward delivery. Anthracene is steady; and a general impression prevails that higher prices will be seen. But in current business, there is little evidence of this. Gas companies continue to hope for higher prices for tar; and seeing that the value of gas coal for next year's delivery is so much increased, it would seem as though they must content themselves with less profit, or raise the price of gas, although in view of the keen competition with electricity, the latter would only be resorted to as a last extremity. Prices: Pitch, 30s. to 36s. per ton. Tar, 27s. to 32s. 6d. per ton, according to position. Benzols (90 per cent.), 3s. 3d. per gallon; (50 per cent.), 2s. 4d. per gallon. Toluol, 1s. 6d. per gallon. Solvent naphtha, 1s. 7d. to 1s. 9d. per gallon. Crude naphtha (30 per cent.), 1s. 2d. per gallon. Light oil, 4d. per gallon. Creosote, 2¼d. per gallon. Carbolic acid (60's), 3s. 4d. to 3s. 5d. per gallon. Cresylic acid, 10d. per gallon. Anthracene (30 per cent.), "A" quality, 1s. 1d. to 1s. 1½d. per unit; "B" quality, 11½d. to 1s. per unit.

Ammonia Products.—Sulphate is not quite so strong; and to-day's price may be taken at £11 17s. 6d. to £12. Other prices are the same as last week.

PROPOSED UNIFORM METHOD OF RECORDING THE RESULTS OF WATER ANALYSIS.

About two years ago the American Association for the Advancement of Science brought before the members a proposition for adopting a uniform system of recording the results of water analysis. The matter was mentioned in the JOURNAL at the time; and it was considered by the British Association at their meeting in the same year, with the result that it was referred to a Committee, consisting of Professors Dewar, E. Frankland, and Odling, Mr. W. Crookes, and Dr. Percy F. Frankland (who also undertook the secretarial duties), to confer with the Committee of the American Association, and report. This they did; their report, which was presented at the recent meeting in Newcastle, being as follows:—

In order to ascertain the general feeling of chemists in this country on the subject, we circulated the following series of questions amongst the leading water analysts, upon whose co-operation the adoption of any uniform scheme must necessarily depend.

1. What is the system of recording the results of water analysis which you adopt? (*a*) for the mineral matters; (*b*) for the organic matters; (*c*) for the gaseous matters.

2. Have you any objections, and, if so, what are they, to the use of a decimal system—such as parts per million, per 100,000, per 10,000, or per 1000?

3. In recording the results of complete analysis of the mineral matters present in water, is it your custom to state the proportion of each individual base and acid as actually determined, or to combine the bases and acids so as to form salts?

4. Should it be your custom to combine the bases and acids, explain the principles by which you are guided in so combining them, and state what, in your opinion, are the advantages attaching to such combination.

5. If your present method of recording results is more or less influenced by special circumstances, such as the custom of professional chemists generally, what other method of recording results would you yourself select as the most rational and the most convenient for universal adoption?

6. Would you support the adoption of the following method recommended by the American Committee, of stating the constituents of a mineral water?—"That the parts per 1000 of each basic element, K, Na, Li, Ca, Mg, Fe'' (Fe_2), &c., be given, and of each acidic element, such as Cl, I, S, &c., that is combined directly with a basic element, or that may reasonably be supposed to be so combined, the rest of the acidic elements to be given in connection with all the oxygen of their salts, as usually written in our present empirical formulæ, as SO_4, CO_2, PO_4, &c."

From the answers we have received to the above questions, as well as from our own personal experience, we gather that there would be no reluctance on the part of British chemists to adopt a uniform and rational scheme, but for the great difficulty of rendering such a method of statement popularly understood. Thus the majority of analysts employ the "grain-gallon" system of statement, as being the one most intelligible to their clients. This system undoubtedly possesses certain advantages in the case of analyses for technical purposes, in which the analytical figures have to be applied to large volumes of water, which in this country are almost invariably measured in gallons. We find, however, a general readiness on the part of most analysts to adopt a uniform and prescribed system; only to be departed from in special cases; and we are of opinion that it would be impossible to secure more than such a qualified consent to any one system.

Although there is but little possibility of directly influencing the custom of professional chemists in their private practice, we are of opinion that it is of great importance to urge upon water analysts the desirability of adopting some uniform system in the cases of such analyses as are communicated to scientific societies or other learned bodies, and which are therefore calculated to have a circulation in countries where the Imperial gallon is not recognized; and if such uniformity could be secured, there is but little doubt that the system would before long establish itself, even in the case of analyses of a non-public character.

As regards the method of statement which would be most suitable for general use in such published analyses, we are of opinion—

(1) That it should be on the decimal system, preferably parts per million (milligramme per litre) or parts per 100,000, as parts per 1000 (grammes per litre) would too frequently give rise to fractional results. The special advantages attaching to "parts per 100,000" are that the figures for mineral waters are not inconveniently large, nor those for potable waters inconveniently small; whilst their conversion into grains per gallon is a very simple operation. We cannot agree with the American Committee that different scales should be adopted for mineral and potable waters respectively; for such a dual system must, in our opinion, inevitably lead to confusion.

(2) We attribute the greatest importance above all to the clear statement, in every case, of the actual determinations made, and that all results derived by calculation should be sharply distinguished from those obtained by direct determination. Thus we view with particular disapprobation the statement of the mineral ingredients combined as salts, unless accompanied by a clear account of the analytical data upon which this statement is founded.

(3) As regards the statement of the mineral ingredients, we have considered the method suggested by the American Committee, and which consists in according the proportion of each metallic element (K, Na, Li, Ca, Mg, Fe'', Fe_2, &c.) as well as that of each electro-negative element (F, Cl, Br, I, S, &c.) contained in binary compounds, whilst in the case of oxy-compounds the electro-negative element is given as combined with the whole of the oxygen (SO_4, PO_4, NO_3, CO_3, &c.), and we are of opinion that this arrangement is decidedly the most convenient for all purposes of calculation, although the absence of any recognized names for these acid groups, as well as the prevailing custom of estimating the metallic elements in the conditions of bases (K_2O, Na_2O, CaO, &c.) are undoubted objections to this system.

(4) That the amount of dissolved gases (O, N, CO_2, SH_2 &c.) may be most conveniently expressed either in cubic centimetres per litre or in volumes of gas per 100 volumes of water; the latter being the more general practice in this country.

Accompanying the report was the form suggested by the Committee for the statement of the results of a comple analysis. The following is the portion relating to potable water:—

Results of Analyses expressed in Parts per 100,000.

Total solid matters—	
(*a*) In suspension	
(*b*) In solution	
Organic carbon	
Organic nitrogen	
Oxygen consumed, as indicated by decoloration of permanganate	
Ammonia expelled on boiling with sodium carbonate	
Ammonia expelled on boiling with alkaline permanganate	
Nitrogen as nitrates and nitrites	
Chlorine	
Hardness—	
Temporary	
Permanent	
Total	

The results for the tests for dissolved gases are recommended to be in cubic centimeters, at 0°C. and 760° mm., per litre of water, recorded in the following form:—

Carbonic anhydride (CO_2)	
Oxygen (O)	
Nitrogen (N)	
Sulphuretted hydrogen (H_2S)	

PENN LAMP AND LIGHTING COMPANY, LIMITED.—A Company under this title was registered last week, with a capital of £5000, in £1 shares, to adopt an agreement to acquire certain inventions relating to the manufacture of lamps, &c., referred to therein.

THE ADVANCE IN THE PRICE OF COKE.—Coke in the North of England is advancing rapidly in price; being about double that of last year. Ordinary blast-furnace coke has risen from 13s. to £1 5s. per ton free on board. In consequence of this, and of the rise in the price of coal, there has been an advance of some moment in the price of gas coke. Whilst, a year ago gas coke was sold at 7s. 6d. per ton; there has just been made at Newcastle a large sale at 15s.—exactly double the figure of a year ago.

THE PUBLIC LIGHTING OF FORMBY.—At the meeting of the Formby Parochial Committee last Wednesday, a Sub-Committee appointed to inquire into the cost of lighting the township with gas, recommended that 60 lamps should at once be provided, the total expense in connection with which for the current year would be under £335 5s. 10d.; that in the following year 40 additional lamps should be provided, the cost of which, with the current expenditure, would entail a total expenditure for the year likewise of under £335 5s. 10d.; and that in the third year 20 additional lamps should be provided, the total cost in connection with which, and the lighting, would also entail an outlay of under £335 5s. 10d. After a short discussion it was resolved, that the matter be left over, and discussed at the next meeting, so as to afford the ratepayers an idea of what the cost of lighting the township would be.

THE PUBLIC LIGHTING OF SALFORD.—At the last meeting of the Salford Town Council, the subject of the public lighting was brought forward on a motion by Mr. Phillips asking for immediate steps to be taken to improve it. He said he found that the burners in some of the lamps of the principal streets were so regulated as to consume only 3½ cubic feet of gas per hour; and Salford had a great deal of blame for bad gas. The average consumption of gas per lamp in 1887 was 10,383 cubic feet; while in Manchester it was 16,000, and in London 20,000 cubic feet. It showed that Salford was very far behind in the lighting of its public lamps. Alderman Hall seconded the motion. Alderman Nuttall said several attempts had been made to improve the street lighting of the Salford district; but the Gas Committee had thought it might be left over until next winter. An expression of opinion by the Council in favour of improved lighting should be brought before the Salford District Committee. Mr. Linsley urged that attention should be given to the lighting of back streets. The motion was adopted.

STRIKE OF GAS STOKERS AT BURY.—Last Saturday the whole of the gas stokers and about two-thirds of the yard-men employed at the Bury Corporation Gas-Works struck work. For some time the men have been employed at 4s. 8d. per day of twelve hours; and they asked for 5s. a day of eight hours. Their demands were conceded; and it was thought everything had been arranged. The yard-men asked for 22s. per week in place of £1, and time-and-a-half for Sunday. After the Council meeting last Saturday, four of the men met the Gas Committee, having already struck work. The price paid was 5s. per day for every two tons of coal carbonized; but as some of the men did not carbonize the full quantity, a proportionate reduction in their wages was made. This the men resented; insisting that they should be paid the full 5s. and price-and-a-quarter for all coal carbonized above the quantity. It was thought that this was a very one-sided arrangement. When the interview, which was peremptorily demanded, took place, the men produced a document which they asked the Committee to sign, saying they were the Manchester terms. The Committee declined to comply without inquiry; but promised, if there were any differences in carrying out the arrangements, to remedy them on explanation yesterday. The men refused these conditions, and would not return to work. A number of the fire brigade labourers and others were procured to replace them; but, of course, they were not equal to all the strikers, and consequently the streets were in darkness on Sunday night.

AN EXPLOSION AT THE SUNDERLAND GAS-WORKS.—Last Wednesday night, the main pipe leading from the retort-house at the Sunderland Gas-Works became blocked, and it exploded; the flames reaching the roof, which caught fire in several places. A fire-engine was quickly upon the scene, and those in command, with the assistance of the workmen, fortunately succeeded in preventing the fire spreading.

FAILURE OF THE ELECTRIC LIGHT AT TEMESVAR.—On Monday evening last week the electric light failed at Temesvar (Hungary), where it is in general use; causing great excitement, almost amounting to panic. The accident is attributed to faulty connection of the wires. In consequence of this a fire broke out in the building occupied by the Chamber of Commerce; and from the same cause the subterranean wires melted in a private house.

EXPLOSION AT THE HONITON GAS-WORKS.—On Friday, the 1st inst., an explosion occurred in the meter-house at the Honiton Gas Works, owing to a leakage of gas from a defective governor. All the windows in the house were broken; and the Manager (Mr. Bailey) was seriously burnt. By his prompt action, however, in turning off the gas, and, with the assistance of two of the workmen, extinguishing the fire, the damage, which is estimated at £100, was restricted to the place of origin.

SOUTHAMPTON GAS AND COKE COMPANY.—The half-yearly meeting of this Company was held last Wednesday, when the Chairman (Mr. R. C. Hankinson, J.P.) moved the adoption of the Directors' report, which stated that the result of the working of the concern during the past six months was an amount available for dividend of £8884. The works were, it was said, in an efficient state, and fully equal to meet the demands of the coming winter. The Directors were also pleased to report that the Company had been called upon for further supplies of gas in the outlying districts, which had necessitated the extension of mains to meet the requirements of the new consumers. The report was adopted; and the maximum dividends were declared, amounting to £7135 for the half year on all classes of shares, less income tax, and payable on Nov. 22; leaving a balance of £1749 to be carried forward.

THE NORTHERN COAL TRADE.—The coal trade of the North of England has shown increased activity during the past few days; the shipments being larger, and the home demand very strong. For best Northumbrian steam coals the price is now firm at 10s. per ton, free on board; and some large contracts have already been concluded for next year at an advance on this figure. Small steam coals are quoted at 5s. to 5s. 6d. per ton, which is just about double the price asked for this class of coal a year ago. In gas coals there is a strong demand, and the price varies considerably. There are important contracts for best gas coals running at about 6s. per ton, free on board, some of which will go into and over next year. The current price is about 10s.; and contracts at a figure near to this have been placed. Some are now commencing; whilst many more start with the new year. For immediate delivery of odd cargoes as high as 11s. is asked, though it is not known to have been paid. The demand for gas coals is now about at its height; the shipments to London being very heavy, and only limited by the scarcity of steamships. There is a good demand for manufacturing coal; and high prices have to be paid, both for prompt delivery and for coal under contract.

SENSIBLE GAS STOKERS AT NORTHAMPTON.—According to a letter which appeared in the *Northampton Chronicle* on Monday last week, the stokers employed by the Gas Company in that town have emphatically protested against the action of the Gas Workers' Union in a recent attempt made by them to foment dissatisfaction in the gas-works. The letter (which was signed by five of the men) was as follows:—"Sir,—It having come to our knowledge that a so-called meeting of the National Union of Gas Workers was held at the Temperance Hall on Saturday, Oct. 26, at which some sort of a threat was made to leave the town in darkness, we, on behalf of our fellow-workers, wish to repudiate in the most emphatic terms any connection with this Society, or that any dissatisfaction exists in the works. If there is any little thing we think would be a boon to us, we are quite prepared to meet our respected chief and ask it, without the interference or assistance (?) of such outsiders as attended the meeting in question; and we confidently rely upon being received in the same courteous and kindly manner we have hitherto experienced at his hands. So far as the threat concerns the public, we can ask them to put it down to the stupid and silly vamper of ignorance just before the elections."

LOTHAMMER GAS MANUFACTURING COMPANY, LIMITED.—An adjourned meeting of this Company was held on Monday last week (Colonel H. Y. Murray in the chair), when the question of confirming a contract entered into between the Board and Mr. Bower for the purchase of this gentleman's patents, and appointing him a member of the Board, was again considered. It may be remembered that this matter came before the shareholders at a special meeting on the 21st ult. (*ante*, p. 839), when an adjournment took place to allow of an interview between Mr. Bower and Mr. Lothammer. The Chairman now stated that the interview had taken place, but there was no definite result to report to the meeting. The only other question before them, therefore, was whether or not the resolution already submitted should be confirmed. Mr. Lothammer's Solicitor stated that that gentleman wished him to tell the meeting that he did not know any more about Mr. Bower's invention now than he did before the interview, and therefore could not give any opinion upon its value. A motion was then submitted to appoint a Committee of Investigation into the whole of the Company's affairs; whereupon the Chairman remarked that the Board cordially invited such an investigation. After some discussion, the motion was unanimously adopted; and the meeting was again adjourned.

CESSATION OF THE GAS SUPPLY OF PANAMA.—The *Panama Star and Herald* for the 21st ult., contained the following:—"It has been announced that after to-night the Panama Gas Company will suspend the supply of gas; but it is generally understood that this suspension will be permanent, in so far as gas lighting is concerned. The Company claim that their pipes are worn out and useless; and that, owing to the high rate of exchange and the falling off in business, not only are they unable to relay the pipes, but are actually sustaining heavy losses on their coal. In these circumstances, the Directors have sought to be released from their contract with the Government, which has yet several years to run. Another reason urged for the solicited release from their obligations is that an electric lighting plant is now being erected, and that there is not room for two illuminating enterprises. We understand that the Government has declined to entertain the proposal, but has offered to materially increase the subsidy of the Company, whereby they will be enabled to enter into an arrangement with the electric lighting company to carry on their contract to the end of the time stipulated. The reason of this is that the Government is unwilling to loose its hold on the good security it has from the Gas Company. Meanwhile, as only a few electric lights have been put up, the Gas Company have arranged to temporarily light the streets with kerosene oil-lamps. We trust, however, that in a short time the difficulty will have been smoothed over."

ELECTRIC LIGHT WORKS AT WOLVERHAMPTON.—The erection of the electric lighting works of the Electric Construction Corporation, Limited (with which, it will be remembered, was incorporated the Elwell-Parker Company), at Wolverhampton, is to be commenced immediately. An area of 24 acres of land has been acquired for the purpose; and the contract has been let to a local builder (Mr. H. Lovatt) for about £40,000.

ORIENTAL GAS COMPANY, LIMITED.—The Directors of this Company, in their report for the year ended June 30 last, state that the revenue balance (after payment of debenture interest and the addition of £1000 to the reserve account) is £27,192, out of which a distribution of 6 per cent., free of income-tax, is recommended; making, with the interim dividend of 4 per cent. paid in June last, a total of 10 per cent. for the year.

GROWTH OF GAS CONSUMPTION AT HEYWOOD.—The quarterly statement of the consumption of gas, which was presented at the last meeting of the Heywood Town Council, showed that the figures compared very favourably with those for the corresponding period of last year. The gas consumed during the last three months amounted to 6,744,787 cubic feet, as compared with 5,776,652 feet last year; being an increase of 968,000 feet, which, notwithstanding a reduction in price of 3d. per 1000 cubic feet, brought in an additional revenue of £84 15s. 7d. The figures represent an increase of 16 per cent.

THE BOURNEMOUTH IMPROVEMENT COMMISSIONERS AND ELECTRIC LIGHTING.—Closely following their proposal to purchase the local gas and water works (but which proposal was rejected by the ratepayers), the Bournemouth Improvement Commissioners have given their consent to the applications for Provisional Orders of the Anglo-American Brush Electric Corporation and the South of England House-to-House Electric Supply Company. The Brush Electrical Engineering Company have already established works in Bournemouth, and are supplying the light to several hotels and places of business.

A NEW WATER COMPANY FOR SOUTH LINCOLNSHIRE.—For the past eighteen months a Company has been in course of formation, having for its object the provision of good water for the villages and towns of the Lincolnshire Fens, where the supply is very defective. Parliamentary sanction has been obtained for the scheme; and the supply will be obtained from a bore well at Spalding. Spalding contains the only water company in the scope of the proposed undertaking; and the Directors of the former have accepted (subject to the approval of the shareholders) an offer from the new Company to sell the works and plant to them at what is stated to be a "handsome price."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For STOCK MARKET INTELLIGENCE, see *ante*, p. 914.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	−1	5 13 6
100,000	10	,,	7½	Do. 7 p. c.	10	13½—13½	..	5 11 1
800,000	100	1 July	5	Australian (Sydney) 5% Deb.	100	109—111	..	4 10 1
100,000	20	30 May	10	Bahia, Limited	20	26—27	..	7 8 2
200,000	5	15 May	7½	Bombay, Limited	5	7—7½	..	5 0 0
40,000	5	,,	7½	Do. New	4	5—5½	..	5 9 4
380,000	Stck.	14 Aug.	12½	Brentford Consolidated	100	225—240	−3	5 6 6
125,000	,,	,,	9½	Do. New	100	162—167	..	5 10 9
220,000	20	12 Sept.	11	Brighton & Hove, Original	20	42—44	..	5 0 0
320,000	20	27 Sept.	11½	British	20	44—46	−1	4 17 10
50,000	10	12 Sept.	11	Bromley, Ordinary 10 p. c.	10	20—22	..	5 0 0
30,000	10	,,	8	Do. 7 p. c.	10	15—17	..	4 14 1
338,750	10	30 May	10	Buenos Ayres (New) Limited	10	13½—14½	..	6 18 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	107—110	..	5 9 1
150,000	20	14 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 4
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	245—255	−7½	5 7 10
130,000	,,	,,	10½	Do. New do.	100	205—210	..	5 2 4
130,000	,,	28 June	4½	Do. 4½ p. c. Deb. do.	100	122—125	..	3 12 4
557,320	20	14 June	13	Continental Union, Limited	20	48—49	..	5 6 2
242,680	20	,,	13	Do. New '69 & '72	14	33—35	..	5 4 0
200,000	20	,,	10	Do. 7 p. c. Pref.	20	37—39	..	5 2 6
75,000	Stck.	27 Sept.	10	Crystal Palace District	100	200—205	..	4 17 7
234,060	10	23 July	13	European, Limited	10	23½—24½	−½	5 6 1
120,000	10	,,	13	Do. New.	5	7½ 17—18	..	5 8 4
354,060	10	,,	13	Do. do.	5	11½—12	−½	5 8 4
5,470,040	Stck.	14 Aug.	13½	Gaslight & Coke, A, Ordinary	100	244—249	−3	5 10 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—105	..	3 16 3
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	251—256	+1	3 18 1
80,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	123—128	..	3 18 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	182—187	..	4 0 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	158—163	..	4 5 10
468,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	250—255	+2	3 18 8
1,051,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	118—122	..	3 5 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	125—130	..	3 9 3
650,000	,,	,,	6	Do. 6 p. c. do.	100	167—172	..	3 9 9
3,800,000	Stck.	15 May	12†	Imperial Continental	100	216—221	..	5 8 7
75,000	5	14 June	6	Malta & Mediterranean, Ltd	5	5—5½	..	5 9 1
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—115	..	4 6 11
541,920	20	14 June	6	Monte Video, Limited	20	20—21	..	5 14 3
150,000	5	30 May	10	Oriental, Limited	5	8¾—9¼	..	5 8 1
60,000	5	27 Sept.	7	Ottoman, Limited	5	5½—6¼	..	5 12 0
166,870	10	26 July	4	Pará, Limited	10	4½—5¼	..	7 5 3
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	100-105*	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	99—102	..	5 17 8
100,000	10	16 Oct.	10	San Paulo, Limited	10	16—17	..	5 17 8
500,000	Stck.	29 Aug.	16½	South Metropolitan, A Stock	100	300—310	..	5 4 13
1,350,000	,,	,,	12½	Do. B do.	100	224—228	+1½	5 6 4
141,500	,,	,,	13½	Do. C do.	100	240—250	..	5 6 6
600,000	,,	28 June	5	Do. 5 p. c. Deb. Stk.	100	138—142	..	3 10 5
60,000	5	12 Sept.	11½	Tottenham & Edm'ntn, Orig.	5	11—13 *Ex div.	..	4 8 5
				WATER COMPANIES.				
717,467	Stck.	14 June	9½	Chelsea, Ordinary	100	268—278	..	3 7 9
1,720,560	Stck.	16 Oct.	7½	East London, Ordinary	100	213—217	..	3 9 1
544,440	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	143—146	..	3 1 1
700,000	50	14 June	9	Grand Junction.	50	128—132	+1½	3 8 3
708,000	Stck.	29 Aug.	10½	Kent	100	276—281	..	3 14 9
1,043,800	100	28 June	9½†	Lambeth, 10 p. c. max.	100	257—262	+2	3 13 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200—205	..	3 11 9
200,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	119—123	+1	3 5 7
500,000	100	14 Aug.	12½	New River, New Shares	100	363—368	..	3 5 13
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
902,300	Stck.	28 June	6	S'thwk & V'xhall, 10 p.c. max.	100	170—175	−4	3 8 6
1,126,500	100	,,	6	Do. 7½ p. c. do.	100	168—173	..	3 9 4
155,066	Stck.	14 June	10	West Middlesex	100	267—272	..	3 13 6

† Next dividend will be at this rate.

BISHOP AUCKLAND WATER SUPPLY.—Last Tuesday, at the meeting of the Bishop Auckland Local Board, Mr. M. Smith read an exhaustive report on the water supply of the town, proposing, in conclusion, that boiler and pumping machinery be duplicated, and that Government be asked to sanction a loan of £1500 for water-works purposes. Consideration of the matter was adjourned, pending further progress with the water drifts.

NEW WATER-WORKS FOR OSWESTRY.—Yesterday week the Mayor of Oswestry (Mr. Alderman J. Thomas) laid the first stone of the new reservoir about to be constructed at Penygwelly, about six miles from Oswestry, the source of the present supply, for which the new reservoir will provide additional storeage. After the ceremony, the Mayor entertained the members and officials of the Corporation at luncheon.

PROPOSED STOREAGE RESERVOIR FOR PLYMOUTH.—In the JOURNAL for the 22nd ult. (p. 800), reference was made to the various reports which have been prepared on two proposed schemes for a new storeage reservoir, either at the Head Weir or Harter. Mr. T. Hawksley estimated the cost of a masonry wall on each site, to retain about 316 million gallons, as follows:—Head Weir wall, including excavations, £124,169; Harter wall, £86,032. At a special meeting of the Plymouth County Council last Thursday, a resolution was passed, after a protracted discussion, empowering the Corporation "to make and maintain a storeage reservoir in the parish of Walkhampton, at or near the junction of Harter brook with the River Meavy," and to enlarge the powers of the Corporation in regard to their water undertaking.

STAPLEFORD AND SANDIACRE WATER SUPPLY.—An Act of Parliament having been recently obtained for the supply of water to Stapleford and Sandiacre, the promoters of the undertaking are now executing deep borings in the latter parish, under the superintendence of Mr. W. H. Radford, C.E., of Nottingham. They have already reached a depth of 260 feet, and it is hoped that very shortly they will reach the Bunter sandstone, where a plentiful supply of good water will in all probability be found. When it is said that a population of 7000 at present draw their water from shallow surface wells, many of which are very badly polluted, it will be seen how much a regular supply of pure water will be needed. There are many lace factories in the district, which is rapidly growing, and the new water supply will prove a boon both on economic and sanitary grounds.

HECKMONDWIKE WATER SUPPLY.—Last Wednesday, a special meeting of the Heckmondwike Local Board was held for the purpose of considering a resolution of the Dewsbury and Heckmondwike Water Board to promote a Bill in the ensuing session of Parliament for the extension of the time obtained by the Act of 1876, in which to construct the proposed two reservoirs in the Harden Valley (the land for which has already been acquired and paid for); also for power to supply water to townships on the line of the United Boards' conduit, and to lend Heckmondwike money to lay out in plant for the purpose. Mr. Redfearn urged that a clause should be inserted giving Heckmondwike more control over the water-works; and he complained that the Dewsbury Corporation, possessing, as they do, three-fourths of a majority on the Board, should have power to promote a Bill independently of, and without the sanction of Heckmondwike. This they could do, according to the interpretation of the Act by the Town Clerk of Dewsbury. The speaker pointed out that the present supply to Heckmondwike would be adequate for some time to come; but if Dewsbury needed an additional quantity of water they could erect more reservoirs, and compel Heckmondwike to take one-fourth of the additional supply. This was a serious matter for Heckmondwike. Mr. Stead said he did not think Dewsbury would take advantage of Heckmondwike's minority, but concede any reasonable point asked for. He suggested that an early meeting of the Dewsbury Corporation and the Board should be held, for the purpose of equitably arranging the Bill, so that the majority could not persecute the minority. This suggestion was embodied in a motion, and agreed to; and a further resolution was passed, giving the necessary sanction to the United Boards' proposals.

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GWYNNE & BEALE'S PATENT GAS EXHAUSTERS & ENGINES.

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Exhausters of nearly all sizes in Stock.

Prize Medals at all the Great International Exhibitions.

Exhausters equal to a total capacity of more than 26,000,000 cubic feet passed per hour have been supplied by us.

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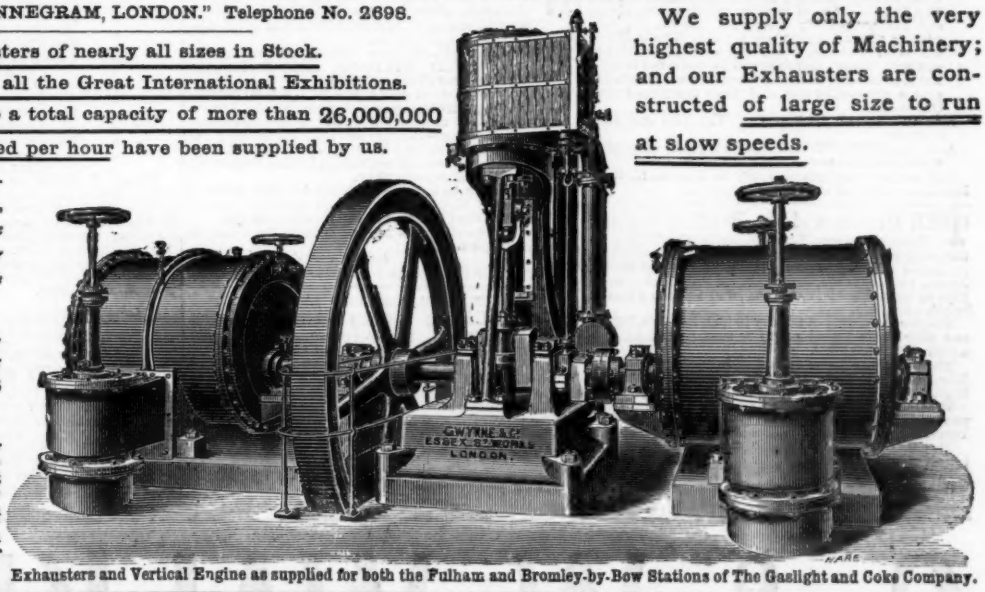
MAKERS OF EVERY DESCRIPTION OF HYDRAULIC AND GAS MACHINERY.

Gwynne & Co.'s New Catalogue and List of Testimonials can now be obtained on application.

We supply only the very highest quality of Machinery; and our Exhausters are constructed of large size to run at slow speeds.



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O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

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JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
No. 54, BERNARD STREET, LEITH, }

TAR and Liquor wanted.
BROTHERTON AND CO., Commercial Buildings, LEEDS.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt, Delivered in carboys or railway tank waggons.
For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street, LONDON.

TIMMIS & CO., of STOURBRIDGE
Make only the best quality of FIRE-CLAY RETORTS, BRICKS, TILES, & LUMPS. Also SPECIAL SILICA BRICKS, to stand great heats. All descriptions kept in Stock.
For Prices apply to JAMES LAWRIE AND Co, 1, Whittington Avenue, Leadenhall Street, E.C., Sole Agents for London and District.
Telegraphic Address: "EIRWAL, LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 948 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.
Telegraphic Address: "Braddock, Oldham."

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

SULPHATE of Ammonia Lead Work and Fittings. Lead Burner. Tanks and Saturators made and repaired on the shortest notice.
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BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.
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JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID for making SULPHATE OF AMMONIA of high quality and colour. *Delivery in Railway Tank-Wagons or Carboys.*
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FOR Rates of Freight, &c., apply to ROBERT BRUCE FITZMAURICE, 9, Crosby Square, LONDON, E.C.

WANTED, six Railway Tank-Wagons, (each holding about 2000 gallons), to Hire, with view to purchase.
State full particulars in detail to No. 1761, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C

GAS CLERK.

A STEADY, respectable young Man, who has just completed his Indentures with the Bridlington Gas Company, desires a further ENGAGEMENT. Has had experience in the general Work of the Office, and is a good Penman.

Apply to the SECRETARY, BRIDLINGTON GAS COMPANY.

WANTED, by a competent Man, a Situation as SERVICE LAYER, METER FIXER, and INDEX READER. Well up in Gas-Fitting, Stove Fixing, &c. First-class Testimonials.

Address A. B., 16, Station Street, STRATFORD, E.

WANTED, a Working Foreman at a Gas-Works on the South Coast, carbonizing about 900 tons of Coal per annum. Good Wages and good House.

Apply to A. B., 60, Pelham Road, SOUTH WIMBLEDON.

WORKING Manager, used to Clay Retort Setting, Exhaust, &c., wanted for the Brecon Gas-Works. Make 20 millions. Wages to commence, 35s. per week, with House, Coals, and Gas.

Applications, with three recent testimonials, to be sent in on or before the 1st of December to EDWIN A. WRIGHT, SECRETARY.

BOROUGH OF ABERAVON.

WANTED, immediately, a practical GAS-WORKS FOREMAN, who must also be a competent Fitter, to take charge of small Gas-Works.

Early applications, with references, and stating salary required to be sent to the Town Clerk, Aberavon, Port Talbot, from whom any further particulars can be obtained.

FOR SALE—A small Country Gas-Works in Suffolk.

Address No. 1763, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Messrs. R. and J. Dempster have FOR SALE, owing to the making of some extensive Alterations at the Coventry Gas-Works—

Five PURIFIERS, 20 feet square, complete with Lids, Grids, Tee-Bars, Lifting Apparatus, &c., &c. The Purifiers are of modern construction, strong and durable, having the Lutes cast on the side Plates; and all Joints are planed. The Purifiers will be sold cheap, either singly or as required to suit purchasers; and they can be delivered free on Rails, or Messrs. R. and J. Dempster will be glad to give a price delivered and fixed complete at any Gas-Works.

Also two 18-inch FOUR-WAY VALVES and Connections.

Also two LIVESEY WASHERS, capable of passing 2 million cubic feet of Gas per day each.

For further particulars, apply to Messrs. R. & J. DEMPSTER, Newton Heath, MANCHESTER.

THE Directors of the Romford Gas and Coke Company, Limited, invite TENDERS for the supply of 900 yards of CAST-IRON GAS-MAINS, 10 inches internal diameter, with Spigot and Socket Joints, turned, bored, and recessed for Lead. Each Pipe to weigh about 4 cwt. 2 qrs., and to work 9 feet in length when laid.

Also for the supply of Sundry 10-inch BENDS, TEES, and SYPHONS (in all about 2 tons); particulars of which will be supplied.

The whole are to be coated with Dr. Angus Smith's Black Solution; and are to be delivered free at Romford Station, G.E.R., in the month of January, 1890.

Tenders, addressed to the Chairman of the Company, and endorsed outside "Tender for 10-inch Pipes," are to be sent in not later than Nov. 15, 1889.

The Directors do not bind themselves to accept the lowest or any tender.

W. D. CHILD, Manager.

Gas-Works, Romford, Nov. 9, 1889.

TENDERS FOR TAR.

THE Directors of the Ludlow Gas Com- pany are prepared to receive TENDERS for the surplus TAR produced at their Works.

For particulars apply to JAMES ELLIOTT, Manager, Gas-Works, LUDLOW.

THE Corporation of Middlesbrough are prepared to receive TENDERS for about 180 tons of SPENT OXIDE. Samples will be sent on application to the Gas Manager (E. D. Latham, C.E.)

The Corporation do not bind themselves to accept the highest or any tender.

CORPORATION OF WORKINGTON.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply and erection of One PURIFIER at their Stanley Street Works.

Drawings and specification may be seen at the Works.

Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Purifier," must be delivered at the Town Hall not later than the 25th inst.

The lowest or any tender not necessarily accepted.

HERBERT LEES,
Engineer and Manager.

Gas-Works, Workington, Nov. 7, 1889.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the purchase of about 350 tons of SPENT OXIDE.

Further particulars and form of tender may be obtained from the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Tender for Spent Oxide," must be sent to me not later than Five o'clock p.m., on Thursday, the 14th inst.

By order,
SAML. BROWN, Town Clerk.

Town Hall, Salford, Nov. 7, 1889.

BLACKPOOL CORPORATION.

TO IRONFOUNDERS AND OTHERS.

NO. 1 Contract.—Tenders wanted for the whole of the CAST and WROUGHT IRON WORK required in the ERECTION of 24 RETORTS in four Furnaces.

No. 2 Contract.—Tenders wanted for about 12 tons of ROLLED GIRDERS and RAILWAY METALS for COAL SIDING.

No. 3 Contract.—Tenders wanted for a REVOLVING WASHER, capable of taking up the Ammonia from 1½ million cubic feet of Gas in 24 hours.

No. 4 Contract.—Tenders wanted for a Set of Four 35 ft. by 25 ft. by 6 ft. deep PURIFIERS, with Covers, Girders, Pillars, Valves, Lifting Apparatus, and Machinery complete.

Tenders must be sent in separately for each contract by the 24th of November, sealed and endorsed outside, addressed to the Chairman of the Gas Committee.

Plans and specification may be seen at the Office of the undersigned.

JOHN CHEW, Gas Engineer.

Corporation Gas-Works, Nov. 5, 1889.

BAHIA GAS COMPANY, LIMITED.

NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Offices, No. 9, Queen Street Place, London, on Thursday, the 21st day of November, 1889, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for general purposes.

The Chair will be taken at Three o'clock precisely.

The Transfer Books are closed from this day to the 21st inst., inclusive.

By order of the Board,
ALFRED J. HEAD, Secretary.

Nov. 7, 1889.

FOR SALE—One Single Gasholder, 80 feet by 20 feet (owing to extensions at Blackpool). To be erected complete; in first-rate condition.

Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet LEEDS.

BOROUGH OF OLDHAM.

THE Oldham Corporation Gas-Works Committee invite TENDERS for supplying and fixing One TELESCOPIC GASHOLDER, 200 feet diameter, required at their Higginshaw Gas Station.

Tenders to be sent in on or before Tuesday, the 19th of November, 1889.

Specification may be obtained, and drawings inspected on application to Mr. Herbert Andrew, at these Offices.

Gas and Water Offices, Oldham, Nov. 6, 1889.

BRISTOL UNITED GASLIGHT COMPANY.

CONTRACT FOR STORES, ETC., 1890.

THE Directors of this Company are pre- pared to receive TENDERS for the supply of their requirement of the under-mentioned STORES and MATERIALS, viz.:—

On form No. 1.—Brushes.
" 2.—Birch Brooms and Chisel Rods.
" 3.—Shovel, Hammer, and other Handles.
" 4.—Timber (English and Foreign.)
" 5.—Rope, Yarn, Old Rope, Rigging, &c.
" 6.—Cotton Waste, Carriage Cloths, and House Flannel.
" 7.—Chamois Leathers.
" 8.—Public Lamp Lanthorn Sides, Tops, and Bottoms, Sheet Glass (English and Foreign), &c.
" 9.—Steel Coke Forks, Shovels, &c.
" 10.—Nails, Files, Screws, Rivets, Pipe Hooks, &c.; Galvanized Iron Buckets.
" 11.—Bolts, Nuts, Washers, &c.
" 12.—Brass and Gun Metal Castings, Main Joint, and other Brass Goods.
" 13.—Lead and Composition Pipe and Block Tin.
" 14.—Red and White Lead, Oils, Turps, Soda, Tallow, Soft Soap, &c.
" 15.—Lubricating Oils.
" 16.—Asbestos Packing and Sheeting.
" 17.—Lamplighters' and other Ladders.
" 18.—Oats and Oatmeal.
" 19.—Sheet and Bar Iron, Tin Plates, &c.
" 20.—Steel Retort Lids and Mouthpieces, Fire-Bars, and other Steel and Iron Castings.
" 21.—Wrought-Iron Tubing and Fittings.
" 22.—Cement.
" 23.—Leather Belting.
" 24.—Disinfectants.
" 25.—Hay and Straw.
" 26.—Cane Baskets.

Forms of tender, upon which only offers will be received, may be obtained on applicat on to the undersigned, at the Offices of the Company, Canon's Marsh, to whom also they must be returned (in the addressed envelopes provided) not later than Ten a.m., on Monday, the 2nd day of December prox.

Contractors are requested to quote the reference number or numbers (as above) of the articles for which they wish to tender.

JAS. V. GREEN, Secretary.

Chief Offices, Canon's Marsh, Bristol,
Nov. 7, 1889.

Price 2s. per dozen, or 10s 6d. per 100, post free.

CONSPIRACY and Protection of Pro- perty Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

C. & W. WALKER.

GASHOLDERS; PURIFIERS; PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT;

RETORT MOUTHPIECES; CONDENSERS;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SLIDE VALVES; TAR BURNERS; &C. &C.

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Showing the Capital, Income, Expenditure, Profits, and Dividends, per Million and per Thousand Gallons of Water Supplied; the Proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied.

For the year ended Dec. 31, 1888, and March 31, 1889.

Together with the Quantity of Water supplied, the Estimated Daily Quantity supplied for Domestic and other Purposes, the Quantity supplied per Head of Population, &c., &c.,

FOR THE YEAR ENDED DECEMBER 31, 1888.

COMPILED AND ARRANGED BY

ALFRED LASS,

Fellow of the Institute of Chartered Accountants.

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A GUIDE TO THE STUDY OF THE

MEASUREMENT OF LIGHT.

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Member of the Society of Public Analysts and of the Committee of the London Section of the Society of Chemical Industry.

Chemist and Superintending Gas Examiner to the London County Council.

The aim of the Author has been to give a comprehensive account of the various methods of Photometry in daily use, and to make the book thoroughly practical by indicating the many precautions necessary for ensuring accurate results in photometrical work. The volume contains chapters on the History and Principles of Photometry; Horizontal, Radial, and Jet Photometers; Standards of Light; the Proposed Substitute for Candles; the Auxiliary Apparatus required in Testing Gas; the Examination and Adjustment of a Gas-Testing Photometer; and Colour and Stellar Photometry; together with an Appendix comprising the Notification of the Metropolitan Gas Referees, Tables for the Correction of Volume of Gas and Observations of Candles, and other matter useful to Photometrists.

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COKE BREAKERS,

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PARK STREET, SOUTHWARK, S.E.

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NEWBATTLE CANNEL.

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DRY CENTRE-VALVE.

WORKING ONE, TWO, THREE, OR FOUR PURIFIERS ON AT THE TIME.

ALSO MADE FOR TWO OR THREE PURIFIERS.

No Springing. No Leakage. No Foul Gas passed in Changing. Special Facility for Blowing the Air out of the Fresh Box before putting in Action, without driving it forward into the Holders.

Write for Prospectus.

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JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road,

CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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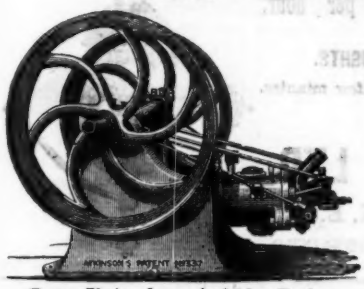

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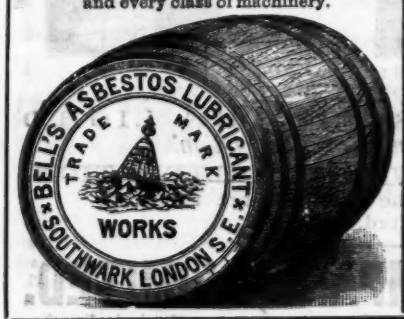

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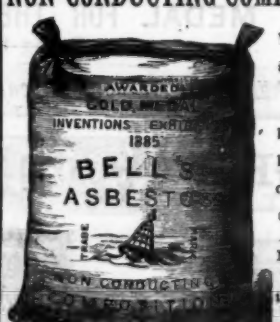

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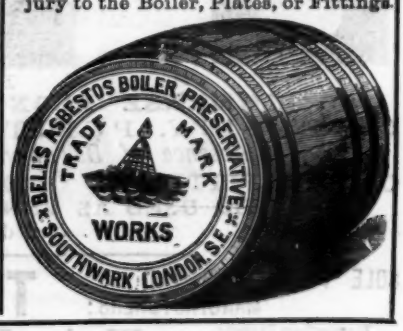

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NO SLIP.

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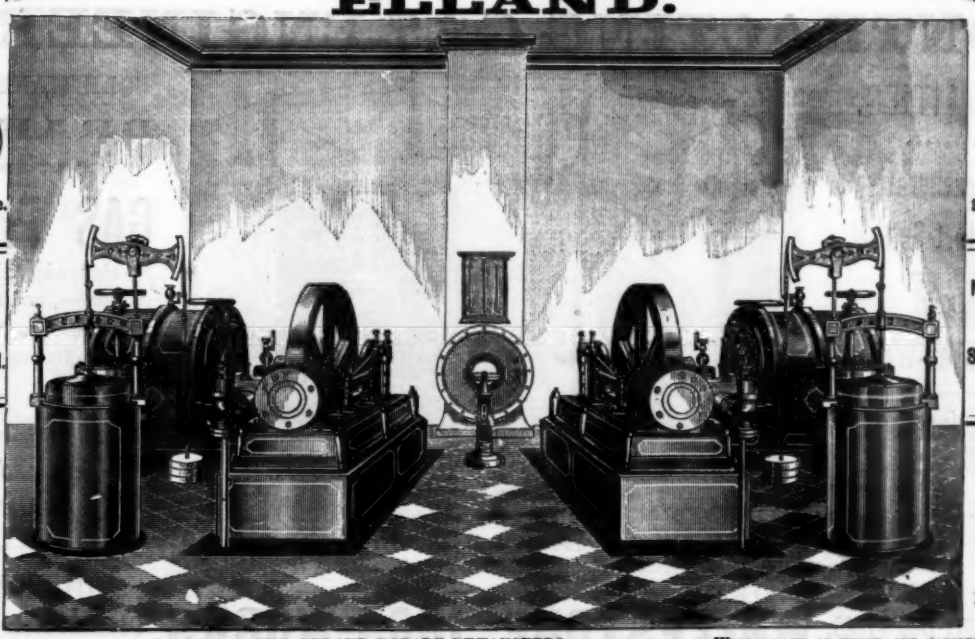

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NO HIGH SPEED.

STEADY GAUGE.

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OVER **160** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

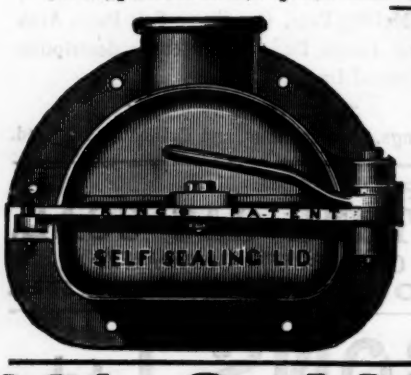
ADVANTAGES ATTENDING ITS USE ARE:—

INCREASED VOLUME of GAS per TON and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE to 15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by Wire Rope, Steam, or Compressed Air.—The power machines are applicable to circular, oval, or ⌂-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made; they are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.



Sole Makers of **CIRCULAR, OVAL,** or ⌂-shaped **MOUTHPIECES,** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

which, by a simple wedging action at each end of the crossbar, secure a very tight joint; and at the same time, by their long sliding motion, they effectually remove the tar or other matter from the surfaces of the mouthpiece and lid.

N.B.—The whole of these Fittings are made of Wrought Iron.

Estimates and further particulars forwarded upon application for Mouthpieces complete, or for Lids and Fastenings separately.

MAKERS OF THOMAS AND SOMERVILLE'S COKE-BREAKING MACHINE.

SOLE MAKERS OF WHITE'S PATENT AUTOMATIC GAS-VALVE.

Mr. JOHN WEST, M. Inst. C.E., Managing Director.

ILLUSTRATED CATALOGUE SENT UPON APPLICATION.

W. C. HOLMES & CO.,

CONTRACTING GAS ENGINEERS.

SPECIALITIES.

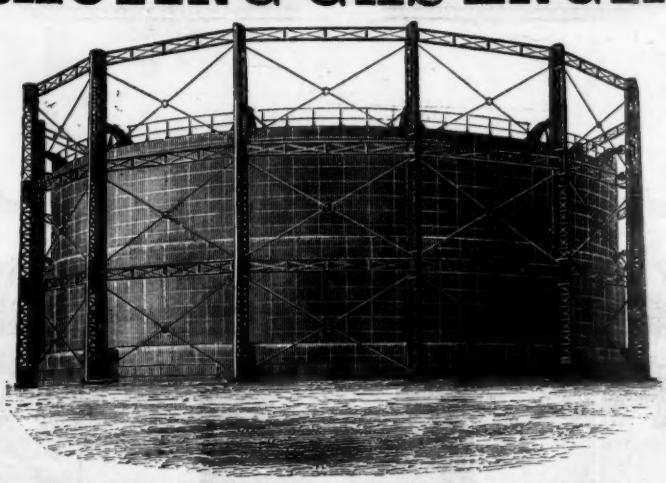
Patent Regenerative Retort-Settings.

Patent Rotary Scrubber-Washer.

Patent Reciprocating Exhauster.

Patent Regulator.

Patent Anti-Dip Pipes.



Treble-Lift Gasholder, 130 ft. by 60 ft., as erected at Burton-on-Trent.

SOLE MAKERS OF

DRAKE'S PATENT GAS PLANT

Specially adapted for Country Places, and for mixing with Coal Gas to increase Illuminating Power.

Condensers, Scrubbers, Purifiers, and all Fittings for Gas-Works.

IMPROVED CHEMICAL PLANT.

WHITESTONE IRON-WORKS, HUDDERSFIELD,

AND

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For Cablegrams: "Ignitor London."

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